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22ND INTERNATIONAL MEETING ON FORENSIC MEDICINE ALPE-ADRIA-PANNONIA JUNE 5-8, 2013, KRAKÓW, POLAND

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Nagły zgon z powodu hipertermii złośliwej podczas znieczulenia ogólnego

Z Katedry i Zakładu Medycyny Sądowej UM w Łodzi
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Kierownik: dr hab. n. med. prof. nadzw. W. Krajewski

W prezentowanej pracy autorzy przedstawiają przypadek hipertermii złośliwej. Omawiana jest sprawa zgonu 4-letniego chłopca, który pod opieką rodziców zgłosił się na leczenie stomatologiczne w znieczuleniu ogólnym. Początkowo zabieg przebiegał prawidłowo, jednakże nieoczekiwanie wystąpiły powikłania w postaci zaburzeń rytmu serca, wzrostu temperatury ciała i sztywności mięśni, charakterystyczne dla hipertermii złośliwej. Pomimo przeprowadzonej akcji resuscytacyjnej i pomocy zespołu pogotowia ratunkowego, pacjent zmarł.

Słowa kluczowe:
opinia sądowo-lekarska,
hipertermia złośliwa, znieczulenie ogólne

WSTĘP

Hipertermia złośliwa to bardzo rzadka choroba uwarunkowana genetycznie, dziedziczona w sposób autosomalny dominujący [1, 2, 3]. Zdarza się raz na kilka – kilkanaście, a nawet kilkadziesiąt tysięcy znieczuleń [3] i może mieć charakter śmiertelny [1, 2]. Charakteryzuje ją niezwykle szybki wzrost temperatury ciała podczas zabiegów przeprowadzanych w znieczuleniu ogólnym, zwłaszcza z użyciem wziewnych środków halogenowych i chlorku sukcynylodwucholiny (suksametonium) [1, 2, 4]. Jest to bardzo groźne schorzenie, może prowadzić do zgonu, jednak współcześnie śmiertelność z powodu wystąpienia hipertermii nie przekracza 10% [1, 2]. Zmniejszenie śmiertelności wiąże się z szybkim podaniem dantrolenu sodu [5] i wdrożeniem intensywnej terapii [6]. Wcześniej śmiertelność nieleczonej hipertermii złośliwej wynosiła powyżej 70-80% [7].

Do wystąpienia tej choroby może dojść po podaniu leków z bardzo wielu grup: anestetyków dożylnych – ketaminy, anestetyków wziewnych – halotanu, izofluranu, enfluranu, fluroksenu, desfluranu, środków zwiotczających mięśnie szkieletowe – suksametonium, deksametonium, galaminy, d-tubokuraryny, leków sympatykomimetycznych, leków nasercowych – glikozydów naparstnicy, wapnia, a także w hiperkapnii lub w stanie nasilonego stresu [1, 2, 3].

Nieprawidłowa, wewnątrzkomórkowa dystrybucja jonów wapnia to najważniejszy czynnik w patogenezie hipertermii złośliwej. Jony te przez kanały wapniowe patologicznie napływają do sarkoplazmy [8], a to zaburza funkcjonowanie struktur wewnątrzkomórkowych. Gwałtownie narasta kwasica mleczanowa, do krążenia przedostają się produkty rozpadu komórek, takie jak wapń, fosfor, potas, fosfokinaza kreatyniny, mioglobina, zaś stężenie katecholamin wzrasta [1, 2].

Określenie grupy predysponowanej do reakcji hipertermicznej bazuje na wywiadzie, badaniu klinicznym i zaliczeniu do grupy ryzyka: chorzy z wybranymi chorobami układu mięśniowo-szkieletowego (miopatia central core), miotonią wrodzoną i dystrofią Duchenne'a, epizody hipertermii złośliwej w rodzinie, niewyjaśnione zgony podczas zabiegów operacyjnych i znieczulenia w rodzinie, wystąpienie gorączki lub ciemnego moczu po zabiegu operacyjnym u pacjenta [1, 2, 3].

Wczesnymi objawami hipertermii złośliwej są: sztywność mięśni, tachykardia, sinica, wzrost Pet CO_2 (ilość dwutlenku węgla obecna w wydychanym powietrzu), wzmożona potliwość. Do objawów póź-

nych zalicza się: wzrost temperatury, obniżenie ciśnienia, arytmię, kwasicę metaboliczną, zaburzenia elektrolitowe, rabdomiolizę i DIC, czyli zespół rozsianego wykrzepiania wewnątrznaczyniowego [1, 2, 3, 5, 9]. Temperatura ciała dochodzi nawet do 43-44 st. C, z szybkością wzrostu 1 st. C na 5 minut, jednak na chorobę tę wskazać już może wzrost ciepłoty o 1-2 st. C na godzinę.

Przy podejrzeniu wystąpienia hipertermii złośliwej należy natychmiast zaprzestać podawania anestetyków i sukcynylocholiny [6, 9], wentylować chorego tlenem i podać dantrolen sodu [10, 11] 2,5 mg/kg mc dożylnie (do ustąpienia objawów i dawki całkowitej 10 mg/kg mc), włączyć leki antyarytmiczne (z wyłączeniem blokerów kanału wapniowego), podać wodorowęglan sodu, ochładzać fizycznie, monitorować funkcje życiowe [1, 2, 5, 6]. Dantrolen to lek z wyboru [3, 6, 11], zmniejsza napięcie mięśni, jednocześnie odwracając procesy patologiczne zachodzące w mięśniach w przebiegu hipertermii złośliwej [3]. Jest to jednak lek drogi, o stosunkowo krótkim terminie przydatności, więc nie wszystkie jednostki przeprowadzające zabiegi znieczulenia ogólnego nim dysponują. W Polsce, w związku z niezwykle rzadkim występowaniem tego powikłania, nie istnieją ogólnie przyjęte zasady normujące dostępność tego leku. W praktyce zakłada się, iż anestezjolog wykonujący znieczulenia winien wiedzieć, który najbliższy ośrodek dysponuje tym lekiem, by w razie potrzeby zwrócić się do niego o udostępnienie tegoż. Należy dodać, że dantrolen, by spełnił swe zadanie, powinien być podany maksymalnie w ciągu 30 minut od wystąpienia niepożądanych objawów.

OPIS PRZYPADKU

W sierpniu 2007 roku rodzice zgłosili się ze swoim synkiem, w wieku 3 lat i 10 miesięcy, na zaplanowany zabieg stomatologiczny w znieczuleniu ogólnym. Dziecko miało liczne ubytki próchnicowe, jak również korzenie zębów mlecznych wymagające ekstrakcji. Próby leczenia stomatologicznego podejmowane były wcześniej w kilku gabinetach, jednak bezskutecznie, wobec negatywnej postawy pacjenta i braku współpracy z jego strony ze stomatologiem. W przeddzień zabiegu pacjent został skonsultowany, a rodzice wyrazili zgodę na planowany zabieg. Wywiad ogólny został zebrany, odpowiednia ankieta dotycząca stanu zdrowia dziecka wypełniona przez matkę. Wobec zdobytych danych nie istniały przeciwskazania do znieczulenia ogólnego. Podczas badania przedmiotowego stwierdzono obrzęk policzka prawego i zalecono antybiotyk. Dnia następnego ok. godziny 9:15 pacjenta poddano znieczuleniu ogólnemu, ordynując wymienione leki anestetyczne: Dormicum, Sewofluran, Suksametonium w dawce 1 mg/kg mc, tlen, podtlenek azotu oraz przeciwbólowo Ketonal, ponadto kroplówkę z glukozą. Odbyło się leczenie zachowawcze zębów 61, 63, 64, 65 oraz wykonano ekstrakcję zębów 53, 52, 51, 62 i 84. W trakcie trwania zabiegu, po około 45 minutach, pojawiły się zaburzenia rytmu serca oraz odnotowano wzrost temperatury do 37,4 st. C. Podano Ksylokainę, zaburzenia rytmu ustąpiły, jednak czynność pracy serca uległa zwolnieniu. Sięgnięto więc po Atropinę, jednak efekt terapeutyczny utrzymał się zaledwie kilka chwil. Saturacja krwi zaczęła maleć, lekarz anestezjolog zauważył sztywność mięśni kończyn dolnych i nieanatomiczne ułożenie stóp pacjenta. W tym czasie temperatura ciała osiągnęła poziom 40 st. C, chłopca schładzano zimnymi okładami, doszło do zatrzymania akcji serca. Anestezjolog zaczął podejrzewać hipertermię złośliwą, wezwano pogotowie ratunkowe i rozpoczęto czynności resuscytacyjne. Kontynuował je zespół pogotowia ratunkowego, jednakże wobec ich nieskuteczności, o godzinie 11:25 stwierdzono zgon dziecka. Przeprowadzona sądowo-lekarska sekcja zwłok oraz wyniki badań dodatkowych pozwoliły ustalić, iż zgon nastąpił w wyniku wstrząsu, do którego doszło najprawdopodobniej na tle hipertermii złośliwej.

OMÓWIENIE

W opisanym przypadku wywiad ogólny, zebrany od rodziców, nie dawał podstaw do podejrzewania hipertermii złośliwej, jak również nie stanowił wskazań do wdrożenia rozszerzonej diagnostyki lub też zastosowania działań profilaktycznych w tym kierunku przed samym zabiegiem stomatologicznym. Materiał dowodowy (dokumentacja medyczna, zeznania świadków) ujawnia, iż wprowadzenie do znieczulenia, jego przebieg, jak i samo znieczulenie do godziny 10:00 przebiegało bez powikłań, kiedy to wystąpiły zaburzenia rytmu serca, wzrost temperatury ciała oraz sztywność mięśni. Materiał

dowodowy nie wskazuje na wystąpienie objawu prodromalnego gorączki złośliwej, jakim jest szczękościsk po podaniu suksametonium [3, 12]. W przypadku, gdy do jego zaistnienia dochodzi, może to uniemożliwić intubację pacjenta [14]. Przebieg schorzenia u dziecka był bardzo gwałtowny i powikłany szybkim zatrzymaniem krążenia, co praktycznie uniemożliwiło skuteczne leczenie.

Według oceny biegłych, zabieg stomatologiczny został przeprowadzony prawidłowo, zgodnie z przyjętymi zasadami. Postępowanie anestezjologiczne w kwestii doboru leków i rodzaju znieczulenia było dopuszczalne dla tego typu zabiegów. Chlorek sukcynylodwucholiny to lek coraz rzadziej stosowany, ze względu na działania uboczne, lecz dopuszczony do obrotu i stosowania w lecznictwie. Zastrzeżenie biegłych wzbudziło jednak postępowanie anestezjologa po wystąpieniu powikłań w trakcie znieczulenia. Mianowicie, lekarz, pomimo podejrzenia, że ma do czynienia z hipertermią złośliwą, nie podjął próby zdobycia leku, stosowanego w tego typu przypadkach (Dantrolen). Niezwłoczne podjęcie próby uzyskania brakującego leku i wdrożenie terapii mogły zwiększyć szanse pacjenta na przeżycie. Zaniechanie tej próby naraziło go na bezpośrednie niebezpieczeństwo utraty życia lub ciężkiego uszczerbku na zdrowiu, zakładając, iż istniałyby realne możliwości dostarczenia tego leku przed wystąpieniem nagłego zatrzymania krążenia, a miało to miejsce o godzinie 10:30. Biorąc pod uwagę opis przebiegu choroby, podanie Dantrolenu już po epizodzie zatrzymania krążenia nie dawało realnej szansy na uratowanie życia poszkodowanego. Należy uwzględnić również to, że Dantrolen nie jest lekiem podawanym profilaktycznie przed zabiegiem u osób, które nie należą do grupy ryzyka wystąpienia hipertermii złośliwej, gdyż sam generuje ryzyko wystąpienia objawów niepożądanych.

W toku prowadzonego śledztwa uzyskano informację, iż w dniu zgonu dziecka gabinet stomatologiczny, w którym odbywał się zabieg, nie posiadał na stanie ww. leku, zaś zgodnie z opinią krajowego konsultanta anestezjologii, rezerwa tego leku była zabezpieczona na terenie dwóch jednostek Akademii Medycznej, jednak nikt nie skontaktował się z nimi tego feralnego dnia, w celu uzyskania medykamentu.

Prokuratura wydała postanowienie o wszczęciu śledztwa w sprawie nieumyślnego spowodowania śmierci dziecka, tj. o czyn z art. 155 k.k., wobec faktu, iż zgromadzony materiał dowodowy wskazywał na uzasadnione podejrzenie jego popełnienia. W toku przedmiotowego śledztwa przesłuchano licznych świadków, zgromadzono obszerną dokumentację lekarską oraz dopuszczono dowód z opinii biegłych z zakresu medycyny sądowej Uniwersytetu Medycznego w Łodzi. Ostatecznie prokurator przedstawił zarzut lekarzowi anestezjologowi z tytułu narażenia dziecka na bezpośrednie niebezpieczeństwo utraty życia albo ciężkiego uszczerbku na zdrowiu, tj. o czyn z art. 160 § 3 k.k. W styczniu 2011 roku sporządzono akt oskarżenia. W styczniu 2012 roku obrońca oskarżonej wnioskował o wydanie wyroku skazującego bez przeprowadzenia postępowania dowodowego i wymierzenie kary 10 miesięcy pozbawienia wolności z warunkowym zawieszeniem jej wykonania na okres 2 lat próby. Oskarżona przyłączyła się do stanowiska swego obrońcy, a prokurator, pełnomocnik oskarżycieli posiłkowych, jak i sami oskarżyciele posiłkowi (rodzice chłopca) nie wnieśli sprzeciwu. Oskarżona przyznała się do popełnienia błędu podczas znieczulania dziecka, w wyniku którego nastąpił jego zgon: wobec pojawienia się w trakcie zabiegu typowych dla hipertermii złośliwej objawów, pomimo wysunięcia podejrzenia o wystąpieniu tej choroby u pacjenta, działając nieumyślnie nie podjęła próby uzyskania dantrolenu sodu. Uznano ją winną popełnienia zarzucanego czynu, który stanowi występek z art. 160 § 3 k.k., na tej podstawie skazano i wymierzono karę 10 miesięcy pozbawienia wolności, warunkowo zawieszając jej wykonanie na okres 2 lat. Sąd uwzględnił bowiem właściwości i warunki osobiste oskarżonej, jej dotychczasowy sposób życia i przebieg kariery zawodowej oraz to, że bardzo silnie przeżyła zdarzenia stanowiące przedmiot postępowania i bezpośrednio po nim porzuciła praktykę lekarską. Po ogłoszeniu wyroku oskarżona przeprosiła oskarżycieli posiłkowych.

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Sudden death due to malignant hyperthermia during general anesthesia

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The authors present a case of malignant hyperthermia. The article discusses the death of a 4-year old boy who appeared to be perfectly healthy and underwent dental treatment under general anesthesia. The procedure went well at the beginning, but suddenly complications developed, such as cardiac rhythm disorders and increased body temperature, subsequently, muscle rigidity appeared. Such symptoms are characteristic for an inherited disease called malignant hyperthermia. Despite professionally performed resuscitation and help of an emergency unit, the patient died.

Key words:
medico-legal opinion,
malignant hyperthermia,
general anesthesia

INTRODUCTION

Malignant hyperthermia is a very rare autosomal dominant genetic disease [1, 2, 3]. Its incidence is reported as one case per several thousand, less than twenty or even several score thousand general anesthesia procedures [3] and the condition may be fatal [1, 2]. Malignant hyperthermia is characterized by an extremely fast rise in body temperature during procedures performed under general anesthesia, especially when halogen-containing inhalation agents or succinylcholine (suxamethonium) chloride are employed [1, 2, 4]. It is a very grave disorder that may be fatal, yet presently, the hyperthermia mortality rates do not exceed 10% [1, 2]. Reduced mortality is associated with prompt administration of sodium dantrolene [5] and putting the patient under intensive care [6]. Previously, the mortality rate in untreated malignant hyperthermia was above 70-80% [7].

The disease may develop following administration of pharmaceutical agents belonging to numerous groups: intravenous anesthetics – ketamine, inhalation anesthetics – halothane, isoflurane, enflurane, fluroxene, desflurane, skeletal muscle relaxants – suxamethonium, dexamethonium, galamine, d-tubocurarine, sympathomimetics, cardiac agents – digitalis glycosides, calcium, as well as in hypercapnia and in individuals under intense stress [1, 2, 3].

Abnormal intracellular distribution of calcium ions is the most important factor in the pathogenesis of malignant hyperthermia. The ions pathologically travel through the calcium channels and enter the sarcoplasm [8], what interferes with the function of intracellular structures. Lactic acidosis rapidly develops, cellular debris such as calcium, phosphorus, potassium, phosphokinase, creatinines and myoglobin enter the circulation and concentration of catecholamines increases [1, 2].

Determining which patients are predisposed to developing hyperthermic reactions is based on medical history taking, clinical assessment and the individual's belonging to a risk group: patients with some diseases involving the musculoskeletal system (myopathy central core disease), congenital myotonic dystrophy and Duchenne muscular dystrophy, familial episodes of malignant hyperthermia, familial unexplained deaths during surgical procedures and anesthesia, fever or dark urine following surgery) [1, 2, 3].

Early symptoms of malignant hyperthermia include muscle rigidity, tachycardia, cyanosis, increased Pet CO_2 (the amount of carbon dioxide present in the exhaled air) and increased sweating. Late symptoms encompass elevated body temperature, hypotension, arrhythmia, metabolic acidosis, electrolyte disturbances, rhabdomyolysis and DIC (disseminated intravascular coagulation [1, 2, 3, 5, 9]. Body temperature is as high as 43-44° C, increasing by 1° C every 5 minutes, yet a temperature rise of approximately 1-2° C per hour is indicative of the disease.

When malignant hyperthermia is suspected, immediate discontinuation of anesthetic agents and succinylcholine is indicated [6, 9], the patient should be ventilated with oxygen and administered sodium dantrolene [10, 11] at the IV dose of 2.5 mg/kg (until symptoms resolve and a total dose of 10mg/kg is reached), antiarrhythmic medications should be introduced (excluding beta channel blockers) and sodium hydrogen carbonate should be given; the patient needs to be physically cooled and his vital functions monitored [1, 2, 5, 6]. Dantrolene is a medication of choice [3, 6, 11], which decreases muscle tone at the same time reverting pathological processes occurring in the muscles in the course of malignant hyperthermia [3]. It is, however, an expensive drug with a relatively short expiry date, thus not all medical centers that offer procedures under general anesthesia have dantrolene at their disposal. In Poland, in consequence of an extremely rare occurrence of the complication, there are no generally accepted standards regulating the availability of the pharmaceutical. In practice it is assumed that an anesthesiologist involved in performing the procedure should know which nearest center has the medication at its disposal to be able to approach such a center with a request for making the drug available. It should be added that for dantrolene to fulfill its role, it needs to be administered maximally within 30 minutes after the patient has developed adverse symptoms.

CASE PRESENTATION

In September 2007, parents reported with their son aged 3 years and 10 months for a scheduled dental procedure to be performed under general anesthesia. The child presented with numerous caries cavities and deciduous teeth roots requiring extraction. Attempts at dental treatment had been previously undertaken in several dental offices, but they were unsuccessful in view of the patient's negative attitude and his lack of cooperation. One day before the procedure, the patient was consulted and his parents gave their consent to the planned procedure. General medical history was taken and an appropriate questionnaire addressing the child's health was complexed by the mother. In view of the collected data, there were no contraindications for general anesthesia. Physical examinations showed right cheek swelling and an antibiotic was prescribed. On the following day, approximately at 9:15 a.m., general anesthesia was induced in the patient, using the following anesthetic medications: Dormicum (midazolami maleas), Sewoflurane, Suxamethonium at the dose of 1mg/kg, oxygen, nitrous oxide and Ketonal (ketoprofenum) as an analgesic; additionally, the boy was administered glucose IV. Teeth 61, 63, 64 and 65 were treated conservatively; teeth 53, 52, 51, 62 and 84 were extracted. During the procedure, after approximately 45 minutes, the patient developed cardiac rhythm disturbances and his temperature rose to 37.4° C. Xylocaine was administered and cardiac rhythm disturbances resolved, but the heart rate was decelerated. Thus, atropine was administered, but the therapeutic effect was maintained for several moments only. Blood oxygen saturation started to decrease, the anesthesiologist observed muscle rigidity in the lower extremities and abnormal positioning of the patient's feet. At that time, the boy's body temperature reached 40° C, he was cooled with cold packs and subsequently, he had a cardiac arrest. The anesthesiologist suspected malicious hyperthermia, an ambulance was called for and resuscitation commenced. Resuscitation was continued by emergency service personnel but proved unsuccessful and at 11:25 a.m. the boy was pronounced dead. A medico-legal postmortem examination and the results of additional tests allowed for determining death as a result of shock, which most likely developed due to malicious hyperthermia.

DISCUSSION

In the presented case, the medical history of the patient as reported by his parents did not provide any grounds for suspecting malicious hyperthermia and did not indicate a need for extended diagnostic management or employing any preventive measures prior to a dental procedure. The evidence (medical records, depositions of witnesses) showed that anesthesia induction, its course and anesthesia itself were uncomplicated until 10:00 a.m., when the boy developed cardiac rhythm disturbances, his body temperature rose and muscle rigidity became apparent. The evidence did not point to the patient presenting with a prodromal sign of malignant hyperthermia, i.e. trismus occurring upon administration of suxamethonium [3, 12]. In case lockjaw develops, intubation of the patient may be proven impossible [14]. The progression of the disease was rapid and complicated by a cardiac arrest, what practically rendered effective treatment impossible.

In the opinion of the experts, the dental procedure was appropriately performed in keeping with the standards. Anesthesiological management with respect to selection of medications and type of anesthesia was also admissible in procedures of this type. Succinylcholine chloride is a pharmaceutical that is increasingly less frequently employed due to its adverse effects, but it has been granted marketing authorization and can be used for medical purposes. Nevertheless, the experts expressed reservations as to the conduct of the female anesthesiologist following the patient's developing complications in the course of anesthesia. Namely, in spite of her suspecting malicious hyperthermia, the physician did not attempt to obtain the pharmaceutical employed in such cases (Dantrolene). An immediate attempt at obtaining the medication and a prompt institution of therapy might have increased the chances of the patient to survive. Abandoning of such an attempt placed the patient at a direct risk of loss of life or severe detriment to health assuming there was a genuine possibility for the medication to be provided before a cardiac arrest, which occurred at 10:30 a.m. Taking into consideration the description of the disease progression, administration of Dantrolene after the cardiac arrest episode did not give a real chance for saving the life of the child. It should be also taken into consideration than Dantrolene is not a pharmaceutical that would be prophylactically administered to patients outside the malicious hyperthermia risk group, since by itself, it generates adverse effects.

In the course of the investigation it was disclosed that on the day of the child's death, no Dantrolene had been available in the dentist's office where the procedure was performed, but according to the opinion formulated by the national consultant in anesthesiology, a reserve stock of the medication was maintained in two Medical University-affiliated institutions; however, nobody contacted them to obtain the pharmaceutical on the feral day.

The prosecutor's office gave a decision to open an accident death investigation, i.e. investigation of an offence under article 155 of the penal code, in view of the fact that the evidence indicated reasonable suspicion the said offence had been committed. In the course of the investigation, numerous witnesses were heard, extensive medical records were collected and evidence presented in opinions formulated by forensic medicine experts of the Medical University in Lodz was admitted. Ultimately, the prosecutor presented charges against the anesthesiologist for exposing the child to direct danger of loss of life or severe detriment to health, i.e. an offence under article 160 § 3 of the penal code. In January 2011, an indictment act was prepared. In January 2012, the counsel for the defense put forward a motion for convicting to be pronounced without hearing of evidence consisting in conditionally sentencing the female offender to a ten-month jail term suspended to allow her to perform a 2-year period of probation. The defendant confirmed the position of the counsel for the defense and the prosecutor, the legal counsel to the subsidiary prosecutors and the subsidiary prosecutors themselves (the parents of the deceased boy) did not file an objection. The defendant admitted making a mistake during anesthesia procedure performed in the child, in consequence of which the boy died: in view of the patient developing symptoms typical for malicious hyperthermia in the course of the procedure, in spite of suspicion being raised of the patient suffering from the very disease, acting unintentionally, she did not make an attempt

at obtaining sodium dantrolene. She was acknowledged guilty of the act as charged, i.e. of an offence under article 160 § 3 of the penal code and sentenced to 10 months' imprisonment suspended for a 2-year probation period. The court took into consideration the personal characteristics of the accused, her earlier life and course of professional career as well as the fact that she very emotionally took the events in question and immediately afterwards abandoned her medical practice. Following the pronouncement of the sentence, the accused apologized to the subsidiary prosecutors.

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Niecodzienny przypadek samobójczego zatrucia tlenkiem węgla przy użyciu przenośnego grilla ogrodowego*

An unusual case of suicidal carbon monoxide poisoning committed using a portable barbecue grill

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Śmiertelne zatrucia tlenkiem węgla są dość często spotykane w praktyce medyczno-sądowej. Choć zazwyczaj mamy wówczas do czynienia ze zdarzeniami o charakterze nieszczęśliwego wypadku, to przypadki zatruć samobójczych też nie należą do rzadkości – tak w Polsce, jak również w innych krajach europejskich. Źródłem trującego gazu, mającego posłużyć samobójcy do odebrania sobie życia, bywają zazwyczaj spaliny silników samochodowych i domowych piecyków gazowych w instalacjach podgrzewających wodę uwalniane w zamkniętych pomieszczeniach. W niniejszej pracy pragniemy przedstawić nietypowy przypadek, jedyny w historii krakowskiego Zakładu, w którym do uzyskania wysokiego stężenia tlenku węgla wykorzystano palące się brykiety węglowe w typowym, przenośnym grillu ogrodowym. Liczący 65 lat mężczyzna rozpalił go w zamkniętym od wewnątrz pokoju, gdzie wcześniej uszczelnił wszystkie szpary i otwory wentylacyjne, a przy wejściu zostawił kartkę ostrzegającą współmieszkańców o obecności gazu. Ustalenia śledcze wskazały, że podłożem targnięcia się na własne życie były przede wszystkim kłopoty zdrowotne. Z analizy piśmiennictwa wynika, że taki sposób samobójstwa (mimo dużej dostępności materiałów) należy do wyjątkowej rzadkości w kulturze europejskiej czy amerykańskiej, gdzie literatura przynosi opisy tylko pojedynczych przypadków. Natomiast zwrócono uwagę, iż wykorzystywanie grillów do samobójczych zatruć stało się w ostatnich kilkunastu latach niezwykle powszechne w krajach Dalekiego Wschodu. Wskazano pewne historyczno-kulturowe uwarunkowania mogące mieć wpływ na tak wyraźną geograficzną polaryzację występowania omawianej metody w niektórych państwach azjatyckich oraz przytoczono dyskutowaną w piśmiennictwie naukowym znaczącą rolę mediów w popularyzacji takiego sposobu samobójstwa.

Fatal carbon monoxide poisoning is relatively often encountered in medico-legal practice. Although we usually deal with events of an accidental nature, cases of suicidal character are also quite common, both in Poland and in other European countries. The source of a poisonous gas that is used by a suicide to take his life are usually exhaust fumes from cars and home gas water-heaters that are released in closed spaces. In the present report, the authors present an atypical case – the only such instance in the history of the Krakow Department – where a high carbon monoxide concentration level was achieved by burning briquetted coal in a typical portable barbecue grill. A 65-year old male lit the grill in a room locked from inside, where he had previously sealed all cracks and vents; he left a written message by the entrance where he warned his flatmates about the presence of gas. The investigation determined that the predominant underlying reason of his committing suicide were health problems. As it follows from the analysis of literature on the subject, despite extensively available materials, such a suicide method is exceptionally rare in the European or American culture,

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where isolated cases only are presented. On the other hand, the authors emphasize the fact that within the last score of years, using barbecue grills in suicidal poisoning has become exceedingly common in the Far East countries. The present report points to certain historical and cultural determinants that may affect such a distinct geographical polarization of the discussed method being used in some Asian countries and refers to a widely discussed by specialists significant role of mass media in popularization of such a suicide method.

Słowa kluczowe:
samobójstwo, zatrucie, tlenek węgla, grill
Key words:
suicide, poisoning, carbon monoxide, grill

WSTĘP

Przywołując i opisując niniejszy przypadek na myśl przychodzi łacińska sentencja „non nova sed nove", co oznacza „nic nowego ale w nowy sposób podane". Śmiertelne zatrucia tlenkiem węgla są dość często spotykane w praktyce badań i opinii medyczno-sądowych. W krakowskim Zakładzie Medycyny Sądowej obecnie wykonuje się rocznie około dwudziestu kilku do trzydziestu paru sekcji zwłok, w których przyczyną zgonu jest toksyczne działanie tlenku węgla. Podobnie wygląda sytuacja w innych tego typu jednostkach w Polsce [1]. Badania pośmiertne dotyczą zazwyczaj przypadków ostrych zatruć mających charakter nieszczęśliwego wypadku poprzez przebywanie ludzi w atmosferze podwyższonego stężenia tlenku węgla w powietrzu. Zdarza się to najczęściej na skutek różnego typu pożarów i niekontrolowanego palenia się materiałów, wadliwości domowych urządzeń gazowych lub instalacji wentylacyjno-kominowych (piecyki łazienkowe i kuchenne, piece akumulacyjne opalane węglem), uwalniania się spalin samochodowych podczas prac w zamkniętych pomieszczeniach (garaże), wchodzenia do miejsc, gdzie nagromadził się trujący gaz (zakłady produkcyjne) itp. [1, 2, 3, 4]. Spotykane są również, choć znacznie rzadziej, przypadki śmiertelnych zatruć będących działaniem celowym. Są to zdarzenia pojedyncze i stanowią co najwyżej kilka procent wszystkich skutecznych, zakończonych zgonem, zatruć samobójczych [5, 6]. W takich sytuacjach źródłem tlenku węgla bywają z reguły spaliny silników samochodowych oraz domowych piecyków gazowych w instalacjach podgrzewających wodę, uwalniane w sposób planowy i przemyślany do zamkniętych pomieszczeń. W niniejszej pracy pragniemy przedstawić nietypowy przypadek, jedyny w historii krakowskiego Zakładu, w którym do uzyskania wysokiego stężenia tlenku węgla wykorzystano palące się brykiety węglowe w typowym, przenośnym grillu ogrodowym.

OPIS PRZYPADKU

W październiku 2007 roku dyżurny jednego z komisariatów policji w Krakowie przyjął zawiadomienie o podejrzeniu próby popełnienia samobójstwa przez X, mężczyzny w wieku 65 lat. Zgłoszenia dokonała jego żona Y, która została zaalarmowana telefonicznie przez dwie córki o braku możliwości dostania się do domu. Po przyjeździe na miejsce Y weszła do budynku przez garaż. Na drzwiach jednego z pokoi, który był zamknięty od środka na klucz zobaczyła przyklejoną kartkę z odręcznie napisanym ostrzeżeniem w języku słowackim i angielskim. Informowała ona, że w domu jest gaz – tlenek węgla i należy najpierw otworzyć wszystkie okna oraz drzwi. Kobieta pukała do pokoju, jednak nikt nie odpowiadał.

Przybyli na miejsce zdarzenia policjanci i strażacy PSP dokonali siłowego otwarcia zamkniętych drzwi. Po wejściu do pokoju znaleziono leżącego na podłodze przy wejściu X, który nie dawał oznak życia. Powietrze w pomieszczeniu było silnie zadymione z wyczuwalną wonią spalenizny. Lekarz pogotowia ratunkowego podjął czynności reanimacyjne, które nie przyniosły powodzenia i stwierdził zgon mężczyzny.

Podczas oględzin stwierdzono, że miejscem zdarzenia jest pokój na poddaszu o wymiarach około 7x5 metrów w domu jednorodzinnym, posiadający dwa zamknięte szczelnie okna (zwykłe i dachowe) oraz drzwi, umeblowany w łóżko, komodę, stolik nocny i zestaw telewizyjny. Na środku pokoju stał metalowy, przenośny grill ogrodowy na nóżkach, ciepły w dotyku, a w obrębie jego paleniska był wypalony całkowicie, szary popiół. Obok pod ścianą znajdował się worek z brykietami węgla drzewnego i akcesoria grillowe. Na podłodze obok zwłok leżała kartka papieru A4 z odręczną notatką. Ponadto

ujawniono, że szczelina między skrzydłem drzwi i framugą została szczelnie oklejona taśmą samoprzylepną przymocowaną do ich brzegów. Podobnie zaklejony został wylot wentylacyjny klimatyzatora umieszczonego na ścianie oraz otwór na klucz w drzwiach. Znajdujący się w pokoju na jednej ze ścian czujnik dymu alarmu przeciwpożarowego był zakryty skarpetką.

Y zeznała, że jej mąż nie pracował od długiego czasu ze względu na przewlekłe, liczne schorzenia. Podała, że od ponad dwudziestu lat cierpiał na depresję, przewlekłe zmęczenie, zmiany w mózgu o typie zwapnień i w objawach podobne do choroby Parkinsona. W 1998 roku X, przeszedł operację wszczepienia implantów w obrębie szyjnego odcinka kręgosłupa. W 2004 rozpoznano u niego zmianę nowotworową w mózgu i z tego powodu miał wykonywany zabieg, którego pozostałością był niedowład części twarzy. Latem 2007 roku ponownie pojawiły się dolegliwości bólowe kręgosłupa szyjnego. Przeprowadzona diagnostyka wskazywała na konieczność kolejnej operacji, o której wiadomo było jednak, że opatrzona jest bardzo znacznym ryzykiem niepowodzenia i możliwości paraliżu. Na dzień przed śmiercią X odebrał wynik badania CT kręgosłupa szyjnego, wykonanego w Krakowskim Szpitalu Specjalistycznym im. Jana Pawła II, które wykazało między innymi: stan po zespoleniu blaszką od strony przedniej trzonów kręgów C5-C7, zwężenie przestrzeni międzytrzonowej C4-C5 z uwypukleniem krążka międzykręgowego w kierunku kanału i uciskiem na worek oponowy, zmiany wytwórcze z osteofitami skierowanymi do kanału kręgowego, drobnymi wolnymi ciałami kostnymi i zwapnieniami w więzadle podłużnym tylnym, zwężenie przestrzeni międzytrzonowych C5-C7 z tworzącymi się blokami kostnymi. Y podała, że ze względu na wszystkie swoje choroby jej mąż był osobą bardzo nieszczęśliwą. Nie był załamany nerwowo, ale twierdził, że każda kolejna operacja prowadzi do pogorszenia zdrowia. Odczuwał ponadto nieustanne poczucie uzależnienia od żony (która była wówczas kierownikiem finansowym w dużej firmie), co dodatkowo skutkowało pogorszeniem jego stanu psychicznego. W przeszłości około roku 2001/2002 X miał wspominać synowi z pierwszego małżeństwa o zamiarze popełnienia samobójstwa. Później nigdy już takich myśli nie wyrażał.

Co do bezpośrednich okoliczności zdarzenia Y zeznała, że X widziała ostatni raz tego samego dnia około godz. 8:00. Mąż został sam w domu. Dzwoniła do niego około godz. 13:00 ale nie odbierał telefonu. Córki wróciły do domu około godz. 17:00 i ponieważ nie mogły dostać się do środka zadzwoniły do matki. Około godz. 18:00 Y przyjechała z pracy. Po wejściu policji, straży pożarnej i pogotowia ratunkowego w pokoju, w którym ujawniono zwłoki X znalazła leki nasenne używane przez męża. Według niej brakowało około 120 tabletek. Znalazła też pustą butelkę po wódce i butelkę z wodą oraz list pożegnalny, w którym wyjaśniał, że „nie może tak dłużej żyć, za dużo cierpi i tak jak zrobił będzie lepiej dla wszystkich".

Dnia 27.10.2007 roku w Zakładzie Medycyny Sądowej UJ CM przeprowadzono sekcję zwłok X. Badaniem pośmiertnym stwierdzono: różowo-żywoczerwone zabarwienie plam opadowych i narządów wewnętrznych, obrzęk płuc, nieznaczną miażdżycę aorty i tętnic wieńcowych serca, powiększenie śledziony, przekrwienie narządów wewnętrznych, stan po przeprowadzonej w przeszłości operacji w obrębie jamy czaszki (prawostronna kraniotomia skroniowa) i stan po przebytej operacji kręgosłupa szyjnego z zespoleniem kręgów C5-C7 metalową blaszką. W żołądku obecny był różowawy płyn z białawymi drobinami. Badaniem toksykologicznym stwierdzono we krwi zmarłego obecność alkoholu etylowego w stężeniu 1.3 ‰, a w moczu 0.7 ‰. Oznaczono poziom hemoglobiny tlenkowęglowej, który wynosił 70 %. Prokuratura zleciła tylko podstawowe, przesiewowe badania chemiczno-toksykologiczne z użyciem testów immunologicznych, które w moczu zmarłego wykazały obecność leków z grupy pochodnych 1,4-benzodiazepiny i trójcyklicznych antydepresantów. Na podstawie wyników przeprowadzonych badań pośmiertnych oraz informacji z materiału aktowego przyjęto, że przyczyną zgonu X było ostre zatrucie tlenkiem węgla uwalnianym podczas palenia w grillu.

DYSKUSJA

Przegląd piśmiennictwa światowego wskazuje, że na przestrzeni wielu ostatnich lat w Europie i Ameryce Północnej obserwuje się wyraźny spadek liczby samobójstw dokonywanych poprzez zatrucie tlenkiem węgla, które do pierwszej połowy XX wieku stanowiło jedną z najczęściej wybieranych

metod [4, 5, 7, 8, 9, 10]. Najistotniejszy wpływ na to miały przeprowadzane stopniowo w większości krajów zmiany składu gazu opałowego dostarczanego do gospodarstw domowych. Tym samym utrudniono dostęp do tlenku węgla mającego posłużyć celom samobójczym, a uzyskanie planowanego efektu zaczęło wymagać bardziej złożonych działań. Najczęściej spotykano się wówczas z demontażem instalacji odprowadzających spaliny z domowych piecyków gazowych, odpalaniem silników samochodowych w zamkniętych pomieszczeniach garażowych, doprowadzaniem spalin silnikowych do wnętrza pojazdu.

Grillowanie to smażenie żywności na ruszcie umieszczonym bezpośrednio nad źródłem ciepła, które znane jest od czasów prehistorycznych. Współcześnie ta metoda przyrządzania jedzenia upowszechniła się szeroko na całym świecie ze względu na szeroką dostępność i niewielki koszt eksploatacji, stanowiąc bardzo popularną okazję do towarzyskich spotkań na otwartym powietrzu, zarówno w miastach, wsiach jak i podczas wycieczek plenerowych. Grill, będący urządzeniem do cieplnej obróbki produktów żywnościowych, może mieć formę przypominającą nieco wolnostojący kominek żeliwny, ceglany lub kamienny oraz znacznie powszechniejszą, tańszą i poręczniejszą – przenośną, zazwyczaj metalową (wiele wariantów). Ze względu na źródło energii rozróżnia się grille drewniane, gazowe, elektryczne i węglowe. W tych ostatnich ciepło uzyskuje się poprzez palenie węgla drzewnego do otrzymania tzw. żaru. Ten rodzaj spalania ze względu na swój powolny, niezupełny charakter jest źródłem dużej ilości dymu i tlenku węgla, które jednak nie stanowią żadnego niebezpieczeństwa w przypadku grillowania na wolnym powietrzu. Pomimo tak ogromnej dostępności i powszechności grillów, to sytuacje rozmyślnego wykorzystania ich w celach samobójczych spotykane są w Europie i Ameryce Północnej bardzo rzadko, a literatura przynosi opisy tylko pojedynczych zdarzeń [11, 12, 13, 14]. W dostępnym piśmiennictwie naukowym nie znaleziono natomiast żadnych, nawet kazuistycznych opisów takich samobójstw w Ameryce Środkowej i Południowej, europejskich krajach basenu Morza Śródziemnego, Afryce, na Bliskim Wschodzie, Australii czy Azji Centralnej i Południowej. Najprawdopodobniej wynika to z kulturowych i kulinarnych uwarunkowań wykorzystywania z reguły w tych regionach świata grillów stacjonarnych, a nie przenośnych.

Podobnie, ale tylko do połowy lat dziewięćdziesiątych XX wieku wyglądała sytuacja w azjatyckich krajach Dalekiego Wschodu [15, 16, 17, 18, 19, 20, 21]. W listopadzie 1998 roku pewna kobieta w Hong-Kongu popełniła samobójstwo rozpalając grilla węglowego w sypialni własnego mieszkania. Do tego czasu nie obserwowano i nie opisywano takiego sposobu odbierania sobie życia, a samobójcze zatrucia tlenkiem węgla należały do pojedynczych przypadków. Najprawdopodobniej prekursorską inspiracją były informacje z pewnego filmu (zastosowanie tradycyjnego dla Chin i Japonii, przenośnego piecyka kuchennego – „hibachi") oraz chemiczno-inżynieryjne wykształcenie samobójczyni. Przypadek ten został ze szczegółami przedstawiony w lokalnych mediach, prezentując się na czołówkach gazet oraz telewizyjnych i radiowych wiadomości. Od tego momentu nastąpił lawinowy wzrost samobójstw przez zatrucie tlenkiem węgla przy użyciu rozpalonego grilla, który rozprzestrzenił się szeroko na inne kraje regionu (Tajwan, Chiny, Korea Pd., Japonia). W roku 1999 metoda ta stanowiła już 10.1% wszystkich samobójstw dokonanych w Hong-Kongu (56 zgonów od listopada 1998 do grudnia 1999), a w 2001 stała się drugim co do częstości sposobem odebrania sobie życia obejmując około 25% wszystkich przypadków. Sytuacja ta zmusiła władze do wprowadzenia ogólnokrajowego programu zastępowania grillów węglowych przez elektryczne. Na Tajwanie współczynnik samobójstw przy użyciu węglowego grilla wzrósł z 0.22 na 100 tys. mieszkańców w roku 1999 do 6.48/100 tys. w 2006 roku. W Japonii opisywana metoda stała się najbardziej popularnym sposobem popełniania samobójstw grupowych, w których osoby umawiały się i zawierały przymierze (tzw. „suicide pact") z wykorzystaniem internetu, a następnie w tym samym czasie odbierały sobie życie. W ten sposób w 2003 roku zginęło w tym kraju ponad 3500 osób!

Omawiając niniejsze zagadnienia nie sposób pominąć roli środków masowego przekazu w kształtowaniu nowych zachowań i trendów społecznych. Znaczenie mediów jako źródła informacji dla osób pragnących odebrać sobie życie, swoistego elementarza samobójców oraz inspiracji do określonych działań jest przedmiotem szerokiej analizy i dyskusji

naukowej na wielu płaszczyznach, od dziedzin humanistycznych po biologiczne. Niebagatelne znaczenie ma w tych kwestiach siła, szybkość, łatwość dostępu i powszechność rozprzestrzeniania się wiadomości za pośrednictwem telewizji lub internetu. Należy zwrócić uwagę, że zaprezentowanie po raz pierwszy w mediach Hong-Kongu przypadku zatrucia tlenkiem węgla z wykorzystaniem węglowego grilla zaowocowało w kolejnych dziewięciu tygodniach 22 przypadkami podobnych samobójstw, podczas gdy wcześniej nie odnotowano ani jednego („copycat effect"). Podobną sytuację obserwowano na Tajwanie, w Japonii czy w Korei Pd. Na początku lat dwutysięcznych opisywany sposób samobójstwa dotarł również do Europy, na szczęście jak dotychczas w postaci pojedynczych przypadków.

WNIOSKI

Z punktu widzenia społeczności europejskiej wydaje się zaskakujące tak masowe rozprzestrzenianie się nowej metody samobójstwa oraz wykorzystywanie jej w sposób niespotykany dla naszej kultury i sposobu myślenia. Niewątpliwie decydujące znaczenie miały tu pewne kulturowe uwarunkowania w zderzeniu z wielką siłą przekazu nowoczesnych źródeł informacji. Być może znaczenie miał również fakt, że pod koniec XX wieku i na początku XXI państwa Azji Południowo-Wschodniej i Japonia, po wcześniejszym rozkwicie, dotknięte zostały poważnym kryzysem gospodarczym, co przekładało się na ogólny wzrost zachowań samobójczych.

Przedstawiliśmy kazuistyczny w naszym kraju przypadek samobójstwa z wykorzystaniem grilla, którego kulinarne zastosowanie jest przecież już od wielu lat na całym świecie czymś łatwo dostępnym, bardzo popularnym i powszechnie używanym. Tym samym autorzy pragnęli również pokazać, jak błyskawicznie nowa metoda potrafi w dzisiejszych czasach globalnej społeczności internetowej znaleźć rzesze naśladowców.

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W dniach 14-15 maja 2012 roku odbył się I Kongres nowoutworzonego międzynarodowego towarzystwa naukowego, International Society of Forensic Radiology and Imaging, zorganizowany przez Instytut Medycyny Sądowej Uniwersytetu w Zurychu. Każdy z uczestników Kongresu uzyskał status członka – założyciela Towarzystwa. Program w większości był wypełniony wystąpieniami zaproszonych prelegentów, tylko 9 referatów pochodziło z wyboru zgłoszeń uczestników. Podczas Kongresu ukonstytuowały się władze Towarzystwa z Prof. Michaelem Thali na czele, jak i powołano redakcję nowego czasopisma naukowego: Journal of Forensic Radiology and Imaging.

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Opracowali: Krzysztof Woźniak, Artur Moskała

21st International Meeting on Forensic Medicine Alpe-Adria-Pannonia, Sarajevo 2012

21 Konferencja Alpe-Adria-Pannonia odbyła się w dniach 30 maja - 2 czerwca 2012 roku w Sarajewie, stolicy Bośni i Hercegowiny. Miejscem obrad był Hotel Bosnia. Komitetowi Organizacyjnemu przewodził prof. Nermin Sarajlić, kierujący Zakładem Medycyny Sądowej Wydziału Lekarskiego Uniwersytetu w Sarajewie. Tematem przewodnim konferencji było: „Exhumation-Examination-Identification". Wystąpienia uczestników podzielono na 5 sesji naukowych, podczas których zaprezentowano 48 prac. Na sesji plakatowej przedstawiono 23 prace. Odbyły się ponadto sesje dedykowane: ICRC (International Committee of the Red Cross) – wystąpienia + dyskusja „okrągłego stołu" oraz ICMP (International Commision on Missing Persons). Zwrócić w tym miejscu warto uwagę na podaną informację, iż przy współczesnych metodach identyfikacji na podstawie badań DNA niejednokrotnie zdarza się teraz odnaleźć osobę, która już dawno miała być pochowana po rozpoznaniu przez bliskich…

1 czerwca 2012 roku w ramach Konferencji w sarajewskim Zakładzie Medycyny Sądowej odbyły się warsztaty (workshop): „Examination of exhumed human remains in the mortuary – the contributions of pathologist and anthropologist", które prowadzili Eva Klonowski (antropolog) i John Clark (medyk sądowy).

W ramach 21st International Meeting on Forensic Medicine Alpe-Adria-Pannonia autorzy z Polski przedstawili następujące prace:

1. z Zakładu Medycyny Sądowej Śląskiego Uniwersytetu Medycznego w Katowicach:

- K. Rygol, C. Chowaniec: „Exhumation of mortal remains in the course of beatification and canonization proceedings",

2. z Katedry Medycyny Sądowej UJ CM:

- T. Konopka, K. Woźniak, A. Gross, E. Rzepecka-Woźniak, F. Bolechała, J. Pohl: „Forensic medical examination of exhumed bodies of victims of the aircraft crash at Gibraltar 1943",

- K. Woźniak, A. Urbanik, A. Moskała, E. Rzepecka-Woźniak, P. Kluza, R. Chrzan, M. Kłys: „Three years of routine post-mortem CT examination in the forensic practice in Poland".

Już krótka wizyta w centrum Sarajewa dowodzi celności tematu przewodniego Konferencji. Liczne fasady domów z uszkodzeniami od pocisków, groby w parku miejskim, „sarajewskie róże" – miejsca oznaczające śmierć co najmniej jednej osoby wskutek wybuchu pocisku moździerzowego… Organizatorzy w ramach „War Tour" pokazali fragment około 700-metrowego tunelu przebiegającego pod lotniskiem – jedynego połączenia oblężonego Sarajewa ze światem zewnętrznym (oblężenie trwało od 6 kwietnia 1992 roku po koniec października 1995).

Ale Sarajewo to nie tylko wojna, ale i smak Orientu w południowej Europie. I to również udało się pokazać Organizatorom Konferencji, którzy starali się na każdym kroku umilić czas swoim gościom. Trudno będzie Im dorównać…

Opracował: Krzysztof Woźniak

22nd International Meeting on Forensic Medicine Alpe-Adria-Pannonia June 5-8, 2013, Kraków, Poland

under the Honorary Patronage
of Vice-Rector of the Jagiellonian University for the Medical College
Prof. Piotr Laidler, PhD

The Multiphase Post-mortem CT Angiography (PMCTA) Workshop
will be held
with the support of FUMEDICA (Virtangiomachine®) and SIEMENS (PC Workstations).

Konferencja współfinansowana ze środków
Wydziału Lekarskiego UJ CM
Krajowego Naukowego Ośrodka Wiodącego
2012-2017

UNIWERSYTET JAGIELLOŃSKI
COLLEGIUM MEDICUM
WYDZIAŁ LEKARSKI

KNOW

New Technologies in Forensic Medicine

CONFERENCE PROGRAMME

June 5, 2013

4.00-7.00 p.m. **Registration**

7.00-8.00 p.m. **Get-together**

June 6, 2013

8.00-9.00 a.m. **Registration**

9.00-9.30 a.m. **Official opening of the Conference**

Plenary Session I
moderated by Patrice Mangin and Nermin Sarajlić

9.30 a.m. *Keynote lecture: Postmortem imaging – An important step to the objectified knowledge of forensic findings and expert opinion. The autopsy protocol in the mirror of history*
R. Dirnhofer (Bern, Switzerland)

10.00 a.m. *Keynote lecture: Technical Working Group Postmortem Angiography Methods: Development of multi-phase postmortem CT-angiography and creation of an international network*
S. Grabherr, J. Grimm, A. Rinaldi, J. Vanhaebost, R. Dirnhofer, P. Mangin (Lausanne, Switzerland)

10.30 a.m. *Post-mortem CT-angiography of the brain and craniocervical junction*
P. Flach, G. Ampanozi, L. Ebert, T. Ruder, W. Schweitzer, N. Berger, M. Thali, S. Ross (Zurich, Switzerland)

10.45 a.m. *Complications of heart surgery in PMCT and PMCT-angiography*
B. Vogel, A. Heinemann, H. Gulbins, H. Reichenspurner, K. Püschel, H. Vogel (Hamburg, Germany)

11.00-11.30 a.m. **Coffee break**

Plenary Session II
moderated by Silke Grabherr and Jozef Šidlo

11.30 a.m. *Complications after transvascular interventions in the heart in PMCT and in PMCT-angiography*
H. Vogel, A. Heinemann, H. Gulbins, H. Reichenspurner, K. Püschel, B. Vogel (Hamburg, Germany)

11.45 a.m. *An unusual homicidal stab wound of the cervical spinal cord: a single case examined by post mortem angio computed tomography*
F. Dedouit, F. Savall, F. Z. Mokrane, M. D. Piercecchi, G. Leonetti, H. Rousseau, D. Rouge, N. Telmon (Toulouse / Marseille, France)

12.00 p.m. *Application of MPMCTA to investigating vascular pathology and modified vascular anatomy: A special case of "vascular patchwork"*
S. Sabatasso, F. Doenz, A. Bass, K. Michaud, P. Mangin, S. Grabherr (Lausanne, Switzerland)

12.15 p.m. *A tool for computer-assisted virtual autopsy using surgical navigation techniques*
L. C. Ebert, T. D. Ruder, F. Kluschke, P. Flach, M. J. Thali, G. Ampanozi (Zurich / Bern, Switzerland)

12.30 p.m. *The forensic radiographer: a profession with international training and acceptance*
A. Rinaldi, A. Dominguez, C. Chevallier, J. Grimm, P. Mangin, S. Grabherr (Lausanne, Switzerland)

12.45 p.m. *Accuracy of computed tomography in anthropometric analysis of human skull and its application in superimposition test*
D. Lorkiewicz-Muszyńska, A. Przystańska, W. Kociemba, C. Żaba, T. Kulczyk, M. Glapiński, W. Paprzycki (Poznań, Poland)

1.00 p.m. *Post mortem 3D CT: military application*
M. Arcieri (Italy)

1.15-2.15 p.m. Lunch break

2.15-3.00 p.m. Guided poster tour
moderated by Małgorzata Kłys and Armin Alibegović

7.00-11.00 p.m. Gala Dinner at Wieliczka Salt Mine

June 7, 2013

Plenary Session III
moderated by Pekka Saukko and Krzysztof Woźniak

9.00 a.m. *Keynote lecture: The role of forensic medicine in the investigation and documentation of torture and ill-treatment*
D. N. Vieira (Coimbra, Portugal)

10.00 a.m. *Keynote lecture: The role of forensic anthropology in the process of identification of unknown human remains*
E. E. Klonowski (Reykjavik, Iceland)

10.45 a.m. *Method of age estimation of adults from lumbar vertebrae*
N. Sarajlić, E. E. Klonowski (Sarajevo, Bosnia and Herzegovina)

11.00 a.m. *Identification of burned human remains*
M. Masic, I. Furac, M. K. Vlahovic, M. Kubat, D. Strinovic (Zagreb, Croatia)

11.15-11.45 a.m. Coffee break

Plenary Session IV
moderated by Duarte Nuno Vieira and Beata Havasi

11.45 a.m. *Explosive wounds caused by bombs, hand grenades and mines – specific differential diagnostics*
M. Marcikić, E. Matuzalem Marinović, B. Dumenčić (Osijek, Croatia)

12.00 p.m. *CVA or CLSM for estimation of PMI?*
A. Alibegović (Ljubljana, Slovenia)

12.15 p.m. *Intramuscular hemorrhages in back muscles in agonic death*
J. Vanhaebost, P. Mangin (Lausanne, Switzerland / Brussels, Belgium)

12.30 p.m. *Post-mortem contusions due to forensic examining of mechanical excitability of the muscles – a case report*
F. Bolechała, A. Moskała, E. Rzepecka-Woźniak, K. Woźniak (Kraków, Poland)

12.45 p.m. *New reference tables for predicted heart weight*
J. Vanhaebost, M. Faouzi, P. Mangin, K. Michaud (Lausanne, Switzerland / Brussels, Belgium)

1.00 p.m. *Early markers of myocardial ischemia relevant to forensic pathology: a novel gene expression analysis system complementary to immunohistochemistry*
S. Sabatasso, T. Fracasso, P. Mangin (Lausanne, Switzerland)

1.15-2.15 p.m. Lunch break

Plenary Session V
moderated by Jarosław Berent and Mladen Marcikić

2.15 p.m. *Frequency of classic and stimulant-type designer drugs among suspected drug users in Csongrád Country (Hungary) in 2012*
L. Institóris, Z. Árok, K. Seprényi, T. Varga, É. Kereszty (Szeged, Hungary)

2.30 p.m. *Preliminary results of post-mortem measurements of 3-beta-hydroxybutyrate in liver homogenates*
C. Palmiere. P. Mangin, D. Werner (Lausanne, Switzerland)

2.45 p.m. *A case of suicidal insulin overdose – significance of directed toxicological and histopathological studies for medico-legal opinion*
R. Skowronek, J. Nowicka, E. Czech, M. Chowaniec, K. Rygol (Katowice, Poland)

3.00 p.m. *A revision of mistaken interpretation of expert report in a case of acute radiation syndrome in affected workers after an industrial accident*
R. T. Hadjiev, M. M. Grozeva, A. T. Gegova, T. Shishkova (Sofia, Bulgaria)

June 8, 2013

Plenary Session VI and panel discussion
moderated by Filip Bolechała and Artur Moskała

9.00 a.m. *Riot Control Agents, is it safe and is it legal in contemporary cases, such as in Tahrir square or Occupy Wall Street demonstrations*
S.Toprak (Zonguldak, Turkey)

9.15 a.m. *A lectio magistralis in police department: the serial killer – to be or not to be?*
M. Arcieri, L. Bortolaso, L. Balint (Italy)

9.30 a.m. *Co-morbidity with sexual assault: a case report*
B. Meel (Mthatha, South Africa)

9.45 a.m. *Palm of hands, a new clinical sign during medico-legal evaluation of fatal flame burn injuries*
M. Barzan (Slemania, Iraq)

10.00 a.m. *Honor crimes*
A. Hamuod (Baghdad, Iraq)

10.15 a.m. *To die together*
A. Zummerová, J. Šidlo, R. Kuruc, J. Šikuta, D. Hojsík (Bratislava, Slovakia)

10.30 a.m.-12.00 p.m. Discussion on the development prospects of forensic medicine

Suggested problems:

1. Public awareness of the forensic pathologist / medical examiner profession.
2. The place and importance of teaching forensic medicine in the system of medical education.
3. Capabilities and limitations of financing development in the field of forensic medicine.
4. Opportunities of introducing new research methods and their acceptance by representatives of legal sciences.
5. Perspectives of international cooperation in the field of forensic medicine in reference to modern technical capabilities.

12.00 p.m. Closing Ceremony

ORAL PRESENTATIONS

POSTMORTEM IMAGING – AN IMPORTANT STEP TO THE OBJECTIFIED KNOWLEDGE OF FORENSIC FINDINGS AND EXPERT OPINION. THE AUTOPSY PROTOCOL IN THE MIRROR OF HISTORY

R. Dirnhofer
Em. Professor, Bern

The core business of every expert – it does not matter from which field – is based on the task given to him or her by the judicature to report "findings and an opinion." This is because an opinion must be founded on findings. These are usually then summarized as diagnoses or diagnosis groups. The findings thus form the objective foundation for a personal – that is, subjective – interpretation or an opinion. In this process, the report of the findings, as well as the opinion must occur "according to the best knowledge and conscience".

The central function of the expert lies primarily in reporting the findings on the basis of which the specialist draws his or her argumentation. Through this the expert makes available the facts that are the empirical structure of the case that the court is to decide upon. In this function, the expert complements the expertise of the judge and is thus solely responsible for the correctness of the findings and opinion presented. The expert is obliged to transmit truth in reporting the findings. For this reason, the expert must be highly objective.

The aim of documentation of autopsy has always been a "precised and particularized recording, which grants a complete and faithful perception of the viewed objects" (E. v. Hofmann).

The development of imaging methods allows for placing the documentation on a new level – the "mechanical objectivity", as the images, which have been generated digitally on the basis of physical data, now become the objective basis of the critical, intersubjective discourse (K. R. Popper).

The reporting of findings consists of four parts, which are display, determination, documentation and storage of findings. In all the four parts, the post-mortem imaging approach leads to better solutions regarding objectivity. This is shown with examples.

TECHNICAL WORKING GROUP POSTMORTEM ANGIOGRAPHY METHODS: DEVELOPMENT OF MULTI-PHASE POSTMORTEM CT-ANGIOGRAPHY AND CREATION OF AN INTERNATIONAL NETWORK

S. Grabherr [1], J. Grimm [1,2], A. Rinaldi [3], J. Vanhaebost [1], R. Dirnhofer [1], P. Mangin [1]
[1] University Center of Legal Medicine Lausanne - Geneva, University of Lausanne, Lausanne, Switzerland
[2] Department of Diagnostic and Interventional Radiology, University Hospital Lausanne, Switzerland
[3] School of Health Sciences, Radiologic Medical Imaging Technology, Lausanne, Switzerland

Performing a postmortem MDCT (multi-detector computed tomography) scan is today a routine exam in some forensic institutes, especially in Switzerland. However, an unenhanced CT-scan yields no detailed information about inner organs and blood vessels. To overcome this drawback, postmortem CT-angiography can be performed. Different techniques have, therefore, been proposed. Most of these methods remain in the realm of research techniques without an application in the daily routine. With respect to the current development of postmortem imaging, there is a need to define a standardized method and

technical equipment prerequisites in order to also transform postmortem CT-angiography into a routine examination that can find acceptance in the medico-legal society. The research group for post-mortem CT-angiography in Lausanne has developed such a technique, called the Multi-phase Postmortem CT-angiography (MPMCTA). It consists of the performance of one native CT-scan and three angiographic phases, which are performed after and during the perfusion of the body with a mixture of paraffin oil and an oily contrast agent that has been specially developed for this technique. Additionally, adequate technical equipment has been introduced. Using this approach permits to obtain radiological images of high quality which allow for investigating the vascular system in a way which is impossible using conventional autopsy and seems to be even superior to clinical CT-angiography. By using the MPMCTA approach, the sensitivity of the radiological exam regarding potentially essential vascular findings can be significantly increased. Depending on what findings are sought for, its sensitivity is even higher than the one of conventional autopsy. This means that some cases should absolutely be examined using this new technique, especially cases in which the source of a hemorrhage or a modified vascular anatomy as a result of a surgical intervention need to be detected. However, in order to avoid misinterpretation of the radiological data, it is important to know the pitfalls and limitations of the new technique. First studies with the aim to define the advantages and limitations have already been carried out. In order to define standards for postmortem angiography, an international working group called TWGPAM (Technical Working Group Postmortem Angiography Methods) was created in the spring of 2012. It consists of nine participating institutes of legal medicine situated in six different European countries. Each institute provides a team of forensic pathologists, radiologists and radiographers, which contribute to a common database used for multi-center studies. This presentation explains the development of MPMCTA and the technical equipment. It will also introduce the new international working group and give an overview of its most recent activities and ongoing studies.

POST-MORTEM CT-ANGIOGRAPHY OF THE BRAIN AND CRANIOCERVICAL JUNCTION

P. Flach [1, 2], G. Ampanozi [1], L. Ebert [1], T. Ruder [1], W. Schweitzer [1], N. Berger [1], M. Thali [1], S. Ross [1]

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[2] Department of Diagnostic Radiology, University Hospital of Zurich, Zurich, Switzerland

Purpose: State of the art routine work of legal medicine is incrementally facilitated by unenhanced post-mortem computed tomography (PMCT) with little information about the vasculature due to a lack of contrast. The recently established PMCT-angiography (PMCTA) is performed in order to provide a precise display of vascular and tissue lesions. Vascular pathologies of the head/neck region are cumbersome to dissect manually during autopsy, whilst only targeted preparation is feasible and simultaneously, destruction of other potential forensic findings will occur. The aim of this study was to evaluate if PMCTA of the craniocervical region is a necessary tool to improve quality of autopsy. **Methods and Materials:** A retrospective analysis of 92 consecutive deceased victims examined with PMCTA was evaluated. All the bodies underwent subsequent autopsies. Unenhanced PMCT was performed, followed by achieving subsequent access to the femoral vessels in order to perform PMCTA with an arterial and venous injection. A contrast media mixture of polyethylene glycol and Iopentol was administered. **Results:** The findings of PMCTA could be validated by autopsy. In cases with rupture, aneurysms or dissection of the basilar, vertebral and carotid artery, venous laceration and severed brain stem injury below the level of the foramen magnum, PMCTA even proved to be superior to autopsy. **Conclusion:** PMCTA provides the basis of a focused and quality-improved preparation of the craniocervical junction and intracranial vasculature by revealing pathologies that are frequently missed during autopsy. The newly implemented method of PMCTA has proven to be an adjunct to classic autopsy in detecting neuropathological causes of death.

COMPLICATIONS OF HEART SURGERY IN PMCT AND PMCT-ANGIOGRAPHY

B. Vogel [1, 2], A. Heinemann [1], H. Gulbins [2], H. Reichenspurner [2], K. Püschel [1], H. Vogel [1]

[1] Institute for Forensic Medicine, University Medical Center Hamburg – Eppendorf, Germany

[2] University Heart Center, Department of Cardiovascular Surgery, Hamburg, Germany

Background and Purpose: Death after heart surgery provokes the question whether the intervention, the underlying disease or other pathologies have caused the unfortunate outcome. Autopsy can answer this question in some cases. However, autopsy means effort and costs. To obtain consent may be an obstacle. Furthermore, autopsy destroys/modifies the corpse and the surgical field, which complicates the interpretation. These facts have prompted our investigation. Our objective was to find out whether PMCT and PMCT-angiography can contribute to the analysis of an unfortunate outcome of heart surgery. **Material and Methods:** Since 2008, the Institute for Forensic Medicine of the University Hospital Eppendorf, Hamburg, has performed some 4000 PMCT's. Till 2011, the examination was performed with a 6-row scanner (Philips M 8000: whole body CT, scan thickness 1.2 mm, pitch 1.0; 200 mAS, 120 kV), and thereafter with a 16-row scanner (Philips: whole body CT, scan thickness 1.0 mm, pitch 1.0; 200 mAS, 120 kV). PMCT-angiographies are performed with an oily contrast substance: arterial phase, venous phase, circulation; a modified pump from the heart surgery injects. The heart is scanned with 0.8 thickness, pitch 1.0. Ninety-six PMCT-angiograms have been performed to date; they have been reviewed for complications due to heart surgery. Additionally, observations of complications of heart surgery documented with PMCT have been included. **Results:** PMCT visualized pseudoarthrosis of the breast bone, bleeding into the pericardium, the mediastinum and the pleural space, pneumothorax, failures of drains, malposition of pacemakers, tracheal tubes, drains, gastric tubes. Single observations concerned a cardioesophageal fistula, the position of implanted valves, and intravascular air and gas. PMCT-angiography localized (and eliminated) suture insufficiency, bleeding due to coagulation disorders, insufficiency of an implanted valve, a valve-in-valve therapy attempt, thrombi and vascular occlusion. **Conclusion:** PMCT provides evidence concerning complications after heart surgery. PMCT-angiography visualizes sutures, lumina of the heart, arteries and veins, it localizes valves in relation to the ostia of coronary arteries; PMCT-angiography localizes the bleeding vessels. The digital data allow a repeated 3D display, which facilitates a review. Any unit with a CT-scanner can perform PMCT and PMCT-angiography. PMCT and PMCT-angiography allow the analysis of an unfavorable outcome and they can contribute to quality control.

COMPLICATIONS AFTER TRANSVASCULAR INTERVENTIONS IN THE HEART IN PMCT AND IN PMCT-ANGIOGRAPHY

H. Vogel [1], A. Heinemann [1], H. Gulbins [2], H. Reichenspurner [2], K. Püschel [1], B. Vogel [1, 2]

[1] Institute for Forensic Medicine, University Medical Center Hamburg – Eppendorf, Germany

[2] University Heart Center, Department of Cardiovascular Surgery, Hamburg, Germany

Background and Purpose: After transvascular catheter interventions involving the heart and the aorta, a lethal outcome raises the question what caused death. Autopsy can answer this question. However, autopsy means effort and costs. This leads to the review of material collected by the authors with the intention to clarify in what way post mortem CT (PMCT) and PMCT-angiography can contribute to the investigation of death after interventions involving the heart and the aorta. **Material und Methods:** Since 2008, the Institute for Forensic Medicine of the University Hospital Eppendorf, Hamburg, has performed some 4000 PMCT procedures. PMCT-angiographies are performed with an oily contrast substance: arterial phase, venous phase, circulation; a modified pump from the heart surgery injects. The heart is

scanned with 0.8 thickness, pitch 1.0. Ninety-six PMCT-angiograms have been performed to date; they have been reviewed for complications due to transcatheteral interventions involving the heart and the aorta. Additionally, observations of complications of transvascular interventions in the heart and the aorta documented with PMCT have been included. **Results:** PMCT visualizes bleeding into the pericardium, the mediastinum, the pleural space and the retroperitoneum. It shows the implanted valve (TAVI) or stent and their position. After aorta stenting, stent migration, angulation, perforation and local bleeding become visible as the localization of the stent and its relation to the ostia of large and small arteries. PMCT has the advantage of showing even small amounts of air in the coronary arteries and other vessels. In case of air or decay gas in the vessels, the leaves of the cardiac valves can be seen and analyzed; this is also valid for implanted valves and other devices. PMCT-angiography identifies the bleeding vessel, allows for the detection of thrombi or emboli, the localization of a perforation into and through the myocardium, provides a proof of intracardial rupture and shunting due to dilatation of the aortic valve in TAVI. **Conclusion:** PMCT permits statements concerning complications of transvascular catheter interventions involving the heart and the aorta. PMCT-angiography allows for the identification of the bleeding vessel, the localization of stents and implanted valves and their relation to the ostia of other vessels. Vascular stenosis and obstructions are visible. The digital data permits repeated analyses also in 3 D. PMCT and PMCT-angiography can be performed in any unit which has a CT scanner. They can contribute to quality control.

AN UNUSUAL HOMICIDAL STAB WOUND OF THE CERVICAL SPINAL CORD: A SINGLE CASE EXAMINED BY POST MORTEM ANGIO COMPUTED TOMOGRAPHY

F. Dedouit [1, 2], F. Savall [1], F.Z. Mokrane [2], M.D. Piercecchi [3], G. Leonetti [3], H. Rousseau [2], D. Rouge [1], N. Telmon [1]

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Cases of spinal cord injuries secondary to stab wounds are rare in the literature. In North America, spinal cord traumatisms represent 2.6% of all the traumas, and only 1% is secondary to stab wounds. In most cases, those injuries in North America are secondary to ballistic trauma. In a South African study consisting of 450 cases of stab wounds, the complete cervical spinal cord represented only 4.5% of the cases. Survivors in the majority cases presented with neurological sequels, like tetraplegia or Brown-Sequard syndrome, and lethal cases were rare. We report a case of a 26-year-old woman killed by her girlfriend secondary to multiple stab wounds. A post mortem angio computed tomography was performed before the medico-legal autopsy. The body was prepared with a surgical cannulation of the femoral vessels. After a non-MSCT exploration, a controlled perfusion device (Virtangio® machine) was used with paraffin oil mixed with special contrast agent (Angiofil®), allowing for three time-different acquisitions (arterial, venous, dynamic). This exploration permitted to reveal multiple stab wounds (facial, thoracic, and cervical), with two severe lethal cervical lesions. One of the cervical lesions was located at the upper posterior part of the neck, with a horizontal trajectory, and a complete transversal section of the cervical spinal cord, between the first and the second cervical vertebrae. This lesion was accompanied with venous and arterial sections. The second cervical lesion was anterior, located on the right side, at the base of the neck, and presented along its trajectory an injury of the right internal jugular vein, and a section of the right transverse apophysis of the seventh cervical vertebra. At the facial level, fractures of the right mandible were noted, along the path of one stab wound. At the chest level, a right hemo-pneumothorax was noted, with one scapula bone lesion, secondary to one posterior stab wound. At autopsy, exploration of the spinal cord is always a particular challenge. The access may be anterior or posterior. In this case,

the dissection was easier because of the imaging conclusions. The precise localization of the injured vessels at the upper cervical posterior area was possible only with imaging. Of course only the external examination permitted an exhaustive description of the different wounds. This unusual case due to stab wounds illustrates the complementarity of the post mortem angio computed tomography and autopsy in instances involving those kinds of lesions.

APPLICATION OF MPMCTA TO INVESTIGATING VASCULAR PATHOLOGY AND MODIFIED VASCULAR ANATOMY: A SPECIAL CASE OF "VASCULAR PATCHWORK"

S. Sabatasso [1], F. Doenz [2], A. Bass [3], K. Michaud [1], P. Mangin [1], S. Grabherr [1]

[1] University Center of Legal Medicine Lausanne - Geneva, University of Lausanne, Lausanne, Switzerland
[2] Department of Diagnostic and Interventional Radiology, University Hospital of Lausanne, Switzerland
[3] School of Health Sciences, Radiologic Medical Imaging Technology, Lausanne, Switzerland

Introduction: Multi-phase Postmortem CT-angiography (MPMCTA) has become a routine examination for investigating cases of traumatic deaths and natural deaths in the University Center of Legal Medicine Lausanne-Geneva. This presentation describes a case, in which multiple cardio-vascular changes have been visualized by the new technique. **Case report:** The body of a 71-year-old man was found at his home. The deceased had a long medical history including multiple vascular pathologies and interventions, especially a double coronary bypass, a subclavian stent and an axillo-bifemoral bypass. In view of the vascular anamnesis, the indication to perform MPMCTA was given. Due to a complete occlusion of the femoral arteries, the arterial phase of MPMCTA was impossible to be carried out using the standard procedure. The protocol could, however, be used once the cannulation site was switched from the femoral artery to the axillo-femoral bypass. A conventional autopsy and histological analyses were carried out later on. **Results:** By cannulating directly the lumen of the vascular prosthesis and injecting the contrast-agent mixture into the bypass, the whole vascular system of the head, thorax and abdomen could be visualized. The modified vascular anatomy and all vascular pathologies could be demonstrated in detail. The diagnosis of Leriche syndrome, severe coronary artery disease with an old cardiac infarction and general arteriosclerosis could be established. Additionally, MPMCTA proved the permeability of the two coronary bypasses, the axillo-bifemoral bypass and the subclavian stent. **Discussion:** Axillo-femoral bypass is a method of surgical revascularization used in the setting of symptomatic aorto-iliac occlusive disease. The fact that no retrograde perfusion of the body was possible by femoral cannulation proved Leriche syndrome and the necessity of the surgical intervention to perform an axillo-femoral bypass. The detailed visualization of the vascular system in the obtained images allowed for an easy exploration of the vascular system, especially of the modified anatomy, which was impossible to be visualized during a conventional autopsy due to massive fibrosis at the operation sites. It also allowed for analyzing the permeability of all vascular grafts in a way which would not be possible by a conventional autopsy alone. **Conclusion:** This case demonstrates the utility of MPMCTA for the investigation of bodies with suspected vascular pathologies. It proves its advantages over a conventional autopsy in order to investigate modified vascular anatomy; the report presents the first case in which MPMCTA was performed by injecting the contrast-agent mixture into a vascular prosthesis.

A TOOL FOR COMPUTER-ASSISTED VIRTUAL AUTOPSY USING SURGICAL NAVIGATION TECHNIQUES

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Medical image modalities, especially computed tomography (CT) are becoming increasingly more popular as a means to enhance the outcome of medico-legal investigations. However, in our experience, forensic investigators with no or little training in diagnostic radiology often find it difficult to understand the anatomical orientation of axial cross-sectional PMCT images, which is important if the images are used to plan and perform the autopsy. We addressed this issue by developing a computer-assisted system, which allows for quick and intuitive reslicing post-mortem CT datasets directly at the body using a surgical pointing device. Additionally, the system allows for creating screenshots for documentation purposes. **Technique:** The system is based on techniques from the field of computer-assisted surgery and composed of the following parts: a computer system, a surgical tracker, a tracked surgical pointer, a wall-mounted screen and a set of retroreflective markers for body referencing. The workflow to start the navigation process is as follows. First, the body is placed on the CT table and the retroreflective markers are attached to the body. A CT scan is performed and the reconstructed data are sent to the navigation system using the DICOM network protocols. The navigation software automatically detects the position of the attached markers inside the CT dataset and calculates the registration automatically, using the positional data recorded by the tracker. After these calculations, the surgical pointer can be used to define the reslice plane. A line laser integrated into the pointer marks the intersection line of the reslice plane and the body. **Discussion:** The presented system helps to close the gap between forensic autopsy and forensic radiology. In the future, similar systems might prove to be a valuable tool for planning autopsies, demonstrating findings to medical laymen or for teaching purposes.

THE FORENSIC RADIOGRAPHER: A PROFESSION WITH INTERNATIONAL TRAINING AND ACCEPTANCE

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Post-mortem imaging is becoming increasingly more commonly used in the daily routine of medico-legal investigations. The performance of Post-mortem Computed Tomography (PMCT) in medico-legal centers implies a close collaboration between forensic pathologists and radiologists. Additionally, many centers have also integrated professional radiographers that have now become new members of the medico-legal team. These professionals represent a new link between legal medicine and radiology that used to be missing. As the “forensic radiographers” are confronted with particular questions and problems different from those observed in clinical radiology, a specialty training is necessary. Such a training has been initiated in Switzerland, in a project promoted by the School of Health Sciences and the University Center of Legal Medicine in Lausanne. These two institutions have set up two specific programs: one educational program for students and one for graduated radiographers, both starting their first course in 2013. Student courses: To educate future forensic radiographers, we have decided to develop an international program. Therefore, we have initiated an ERASMUS International Module Exchange in Clini-

cal Forensic Radiography. Students participating in this module will stay in Switzerland for 13 weeks, where they will have theoretical courses in clinical radiography, forensic imaging and forensic sciences. They will also undergo practical training at the University Center of Legal Medicine in Lausanne. Additionally, there will be a cultural program permitting them to discover Switzerland during their stay. Postgraduated training: In order to educate forensic radiographers, this training is open to all graduated professional radiographers. It consists of a two-day course held in English, which comprises a theoretical and a practical part. It teaches important information about the basics of legal medicine and the participants learn the application of various approaches to forensic imaging, such as PMCT, PMCT-angiography and 3D-surface scanning. The aim of this presentation is to explain the role of forensic radiographers in the medico-legal team and to inform about training possibilities.

ACCURACY OF COMPUTED TOMOGRAPHY IN ANTHROPOMETRIC ANALYSIS OF HUMAN SKULL AND ITS APPLICATION IN SUPERIMPOSITION TEST

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Introduction: The personal identification based on skeletal remains is the subject of interest of anthropologists, anatomists, morphologists and forensic medicine specialists. One of the most challenging issues in the identification studies is their methodological aspect, since the reliability of the techniques used in the investigations affects the probability of prediction of the individual's antemortem appearance. The aim of the study was to compare the accuracy of the anthropometric measurements of the skull reconstructed with the use of computed tomography with the corresponding measurements obtained from skeletonized skulls by a direct method and to evaluate the usefulness of the CT image of the skull in superimposition test. **Material/Methods:** Ten skeletonized skulls of estimated age and sex were measured according to anthropological standards. The skulls were scanned by multi-slice computed tomography using the 64-slice CT and for every single specimen, a 3-D reconstruction was performed. The images were examined and linear skeletal dimensions were measured. Finally, two sets of the measurements (direct on the skulls and CT-aided) were obtained. The differences between the corresponding measurements were calculated and the statistical analysis was performed. The photographs of the skeletonized skulls were taken and the image of the skull as seen in the photograph was compared with the image of its 3-D reconstruction by superimposition of the images using the Adobe Photoshop software. **Results:** The superimposition of the images showed an adequate level of convergence between the digital images and the conventional photographs. The comparison of direct and digital measurements showed no statistically significant differences between the majority of the direct measurements of the skulls and their analogues measured on their 3-D reconstructions. All the measurements were accurate, comparable and highly concordant in both direct and CT-aided anthropometry. The linear correlation was strong for comparable measurements of the skull and its 3-D reconstruction. **Discussion/Conclusions:** The present paper demonstrates that the use of CT reconstruction of the skull in identification of a non-skeletonized body is relevant and can effectively replace the skeletonized specimen if it is not available for examination. It has been statistically established that the 3D model accurately depicted the original specimen. It has been proven that the 3D reconstruction of the skull is as useful as a skeletonized skull

for the superimposition test. To summarize, the authors present the case, in which the computer-assisted superimposition applied in the comparison was crucial in determining positive identification and it confirmed the two investigated individuals to be the same person.

POST MORTEM 3D CT: MILITARY APPLICATION

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The aim of this study is to analyze the military application of the "virtual autopsy". **Method:** trough a detailed analysis following a review of about 40 reports (clinical reports and military reports) regarding post mortem 3D CT, we focus our study on military application in the Army of the United States, Israel and Germany, especially through the experiences in Iraq, Afghanistan and Balkan areas. **Conclusion:** our study reveals the importance of military application of post mortem 3D CT in combat areas and difficult operative situations. **Key words:** Post Mortem 3D CT 3D, Army, US Soldiers

THE ROLE OF FORENSIC MEDICINE IN THE INVESTIGATION AND DOCUMENTATION OF TORTURE AND ILL-TREATMENT

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In 1948, humanity marked an important milestone with the adoption of the Universal Declaration of Human Rights. One of its 30 articles (Article 5) stipulates that no one shall be subjected to torture or other cruel, inhuman or degrading treatment or punishment.

Since then, there have been a number of other international regulations that have reinforced the legal obligation of states to prevent, prohibit, criminalize and investigate alleged cases of torture or cruel, inhuman and degrading treatment, as well as the obligation to ensure that all perpetrators are forced to answer for their actions and that victims receive appropriate reparation. However, some 65 years later, there continues to be a marked discrepancy between the law and reality. Torture, ill-treatment and detention in terrible conditions continue to occur all over the world, including countries that are generally considered to be paragons of virtue in the sphere of human rights.

This lamentable situation reinforces the need for a more thorough and systematic investigation and documentation of these practices in all countries. Such an investigation and documentation is essential

if we are to eradicate ongoing abuses and prevent new cases and even possible deaths. But thorough investigation and documentation is also necessary to achieve other objectives, such as ensuring that perpetrators are brought to justice, that victims receive proper reparation (compensation, rehabilitation and other forms of rehabilitation to which they are entitled), and that official bodies and the general public are made aware of such practices in order to prohibit them completely or encourage reform.

The investigation of torture and cruel, inhuman and degrading treatment or punishment is not, however, an easy task. Forensic medicine has in this domain a fundamental role and valuable guidelines about how to proceed in the forensic investigation and documentation of such situations have been developed. The Istanbul Protocol is one of the examples. This role of forensic medicine will involve the assessment of possible lesions and signs of abuse, even in the absence of specific complaints or accusations; the documentation of signs of possible physical or psychological abuse; the interpretation of evidence and deduction of possible causes; proffering an opinion as to the extent to which the medical evidence correlates with the specific allegations made by the examinee and/or agents potentially responsible; making effective use of the information obtained in order to thoroughly document and disclose torture practices; ensuring that the legal and governmental authorities and the local and international community are fully informed of the physical and psychological consequences of the kind of torture used. The afore-mentioned role of forensic medicine will also involve an assessment of the detention conditions that, in some cases, can amount to cruel, inhuman or degrading treatment or punishment.

But to investigate and document such cases with the thoroughness that they deserve requires regular expert practice and a continuous effort to remain abreast of new developments through ongoing training, study and reflection. This can provide contact with new torture situations and their physical and psychological consequences, disseminate knowledge of new means of diagnosis and their potential, generate reflection on experiences arising from interventions in the field, and divulge new standards and guidelines.

This lecture will address the several steps and procedures to be followed by a forensic medical expert in the course of fact-finding missions of torture and other cruel, inhuman and degrading treatments or punishments. The difficulties and pitfalls of this forensic medicine mission are presented based on the participation of the author in this kind of fact-finding missions, as a short-term forensic consultant of the UN High Commission for Human Rights.

THE ROLE OF FORENSIC ANTHROPOLOGY IN THE PROCESS OF IDENTIFICATION OF UNKNOWN HUMAN REMAINS

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PhD, MSc

Forensic anthropology is an applied branch of biological (physical) anthropology concerned with the identification of human remains and associated skeletal trauma related to the manner of death in a legal setting.

The term “forensic anthropology” had been invented in Europe but the field itself was established in the United States in the 1940s. In the 1950s and 1960s, forensic anthropology in the United States became completely professionalized and developed into one of the fields of forensic sciences. However, the term “forensic anthropology” emerged again in the 1970s after the establishment of the Physical Anthropology Section within the American Academy of Forensic Science (AAFS) in 1972.

The American Board of Forensic Anthropology defines forensic anthropology as: „Forensic anthropology is the application of the science of physical anthropology to the legal process. The identification of skeletal, badly decomposed, or otherwise unidentified human remains is important for both legal and humanitarian reasons. Forensic anthropologists apply standard scientific techniques developed in physical anthropology to identify human remains, and to assist in the detection of crime. Forensic anthropologists frequently

work in conjunction with forensic pathologists, odontologists, and homicide investigators to identify a decedent, discover evidence of foul play, and/or the postmortem interval. In addition to assisting in locating and recovering suspicious remains, forensic anthropologists work to suggest the age, sex, ancestry, stature, and unique features of a decedent from the skeleton."

In the United States and Canada, anthropologists routinely participate in all aspects of the forensic analysis of skeletonized human remains, while European forensic anthropology remains primarily within the medical community; nevertheless, the fact is that forensic anthropology is deeply rooted in physical anthropology rather than in medicine. In Bosnia and Herzegovina, medical examiners are officially responsible for anthropological issues and usually the assistance of the forensic anthropologists is not asked for.

Since the dividing line between forensic anthropology and forensic pathology is the presence of soft tissues, therefore, the role of the forensic anthropologist, a specialist in bone examination, can be more then useful and helpful to the medical examiner that is in charge of skeletonized cases or cases involving bodies at various stages of decomposition. The assistance provided by the forensic anthropologist includes aiding in the recovery, examination of human remains with a purpose of establishing the so-called biological profile, analyzing trauma, searching for injuries and tool marks in order to establish a potential cause of death, looking for signs of diseases or other identifying characteristics helping in the identification of the victims, as well as collection of DNA samples. The information about an individual's age, sex, stature and ancestral background can be provided from the remains, which are in an advanced state of decomposition, skeletonized, burned, dismembered or fragmentary.

During the investigation, the anthropologist will conduct a variety of examinations and tests to determine various features to aid in the identification of the victim, identify evidence of trauma which occurred prior to the death and may act as potential identifiers, or identify trauma which caused death. In order to identify human remains, forensic anthropologists apply standard scientific techniques developed in biological anthropology, which are the best suited for the population the examined remains represent.

All the details of the anthropological examination and any other results have to be recorded in a detailed report to be used in further analyses or investigation and potentially in the court, since the forensic anthropologist may be required to stand as an expert witness.

METHOD OF AGE ESTIMATION OF ADULTS FROM LUMBAR VERTEBRAE

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In this presentation, the attendees will be introduced to a new method of age estimation based on changes in the morphology of the lumbar vertebrae. This presentation will make an impact on the forensic community and/or humanity by allowing forensic anthropologists and pathologists to verify and use this new aging method for narrowing age ranges estimation, and, therefore, for more correct estimation of age at death, what is essential in identification of unknown human remains. During the examination of hundreds of skeletal remains exhumed in Bosnia and Herzegovina, the authors found that the pattern of changes observed in the vertebral body can be used as additional indicators for estimation of age at death. The variables that contribute to the overall pattern of changes include (1) the sequence of fusion of the internal rim of the epiphyseal rings to the surface of the vertebral body, (2) the subsequent absorption of the rings into the body, and (3) age-related changes in the superior and inferior edges and surfaces of the body itself. The remains used in this study represented individuals killed during the period from 1992 to 1995 in northwest Bosnia. The remains were exhumed from individual or mass graves between 2001 and 2010. For this study, a series of three vertebrae from 360 skeletal remains representing males of known age were examined. For each individual, the first three lumbar vertebrae

(L1 – L3) were examined. The remains were completely skeletonized. The process of decomposition of the soft tissues and skeletonization was natural and all the examined vertebrae were dry, showing no trace of soft tissue (e.g. free of intervertebral cartilage and periosteum), which allowed for the observation of changes in fusion of the vertebral rings. Three features of the vertebrae bodies were examined: fusion of the internal rim of the epiphyseal rings, changes in the shape of the vertebral body and changes of the texture of the vertebral body. Each vertebra was scored according to the presence and development of those three features occurring with age. In a preliminary study, a comparison of real and estimated ages of the identified remains has shown that age-related changes observed in the vertebral column can contribute significantly to narrowing estimated age ranges, especially for individuals in the age range of 25-45 years, who constitute the majority of the missing persons from Bosnia and Herzegovina. This study will combine different stages for each of three morphological features observed in the lumbar vertebrae in order to develop distinctive phases for age estimation. **Key words:** Age estimation; Lumbar vertebrae; B&H population

IDENTIFICATION OF BURNED HUMAN REMAINS

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Forensic identification of burned human remains is always very difficult; such remains often cannot be identified by conventional means. In such cases, when classical methods are not useful, DNA analysis is usually the only method of choice. DNA analysis is a very powerful method for individualization and identification of skeletal remains and it has been performed in our laboratory for almost 20 years. We will present several cases from our practice involving remains that were badly damaged by fire, what rendered classic identification impossible. We are going to show different kinds of accidents: a plane crash and a car accident, as well as a house fire. Although the remains were highly carbonized, we obtained full DNA profiles from all the typed samples. Therefore, DNA analysis is recognized as the precise and straightforward method of answering the question of identity.

EXPLOSIVE WOUNDS CAUSED BY BOMBS, HAND GRENADES AND MINES – SPECIFIC DIFFERENTIAL DIAGNOSTICS

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Introduction: Explosive wounds caused by shells, mines and bombs account for more than one-half of injuries suffered in modern wars. For example, 85% of the wounds were caused by fragments of explosives in World War II, 90% in the Korean war (1953) and 53% in the Israel-Arab war (1982). Forty-five per cent of victims of all violent deaths (890) were killed by shrapnel and fragments during military activities in Eastern Croatian County Osijek in the year 1991. In spite of a great effort of the Croatian government to clear mine-fields and collect illegally possessed weapons, we are frequently faced with individual and family tragedies caused by detonation of bombs, hand grenades and mines. A relatively high incidence of fatal explosions, 5/100 000 inhabitants per year, is still noted more than twenty years into the post-war period (1992-2012). **Results:** All fatally wounded individuals were analyzed in relation to the location and extent of injuries. In total, 25 victims were killed in consequence of detonation of bombs, hand grenades and mines during the two decades (from 2000 to 2012). Ten

victims committed suicide, eight individuals were killed accidentally and in four incidents, a suicidal perpetrator killed another person. Suicide victims suffered extensive damages over their faces, frontal surface of the trunk and both hands, while the tights, lower legs and feet were spared or sporadically wounded. This specific distribution of injuries was repeated in each analyzed case, indicating that the victim was facing the bomb or was bending over it at the time of detonation. Explosions of concealed mines were a predominant cause of accidental deaths. Farmers, peasants and workers of the task-forces involved in deactivation of mines were among the most frequently wounded people. The unfortunate victims usually triggered detonation of mines fastened to poorly visible pieces of wood or placed on the ground. Devastating injuries repeatedly involved the feet, lower legs, thighs, buttocks and abdomen. In the circumstances of combined suicide-homicide by bomb detonation, suicidal perpetrators and homicide victims were standing or sitting close together. As they were in a close position, similar destructive injuries were distributed over the head, frontal surface of the chest, arms and hands of both victims. **Conclusion:** The location and extent of explosion injuries is of uppermost significance in the conclusion of a fatal incident. A forensic pathologist may be able to assist in reconstructing the event, as the distribution of wounds indicate the relative position of the victims and bomb at the time of explosion.

CVA OR CLSM FOR ESTIMATION OF PMI?

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Introduction: In our in vivo studies of cartilage we have shown that chondrocyte viability changes predictably as a function of time and ambient temperature and this could be used in estimation of post-mortem interval (PMI). The main technologies employed in our studies were based on special staining with the use of a cell viability analyzer (CVA) and a confocal laser scanning microscope (CLSM). **Material and methods:** CVA - The chondral part was split off the osteochondral cylinder, diced to small pieces and enzymatically digested in collagenase II solution. The degraded cartilage samples were washed through a cell strainer and re-suspended in a DMEM/F12 solution. The chondrocyte suspension was treated with trypan blue vital dye included in the kit for automatic dyeing. Viable cells resist dye passage through the membrane, therefore only dead cells are marked intensively blue. The CVA automates the trypan blue vital dye exclusion method for the determination of cellular viability. Dead and living cells were counted automatically. CLSM - 300μm thick cartilage slices were cut out from the osteochondral cylinders. They were stained using the Live/Dead Viability/Cytotoxicity Kit, which includes calcein-AM and ethidium homodimer-1. Calcein is a membrane permeable non-fluorescent substrate that passively diffuses into cytoplasm. After intracellular enzymatic hydrolysis, the remaining calcein is trapped by intact cell membranes and emits a green fluorescence when excited, indicating that the cell is considered viable. Ethidium diffuses through the porous membranes of dying or dead cells and has a high affinity to nucleic acids, and emits a bright red light when excited. Slices were scanned with a CLSM equipped with an argon-krypton laser. The selected location on each slice was 40 μm deep into the specimen and captured by 7 images placed one above another with a 10 μm in-between interval. Micrographs with green and red-colored spots, denoting live and dead cells, respectively, were arranged by the included software. The cells were counted manually. **Results and discussion:** Although CLSM in combination with Live/Dead staining provided the most reliable measurements, technical difficulties (laser microscope scanning, manual cell counting) and the costs do not support CLSM usage in routine forensic work. CVA with automatic cell counting is more user-friendly and reproducible, and it still offers a high level of reliability. **Conclusions:** Determining chondrocyte viability could be a new method for estimation of PMI in the late postmortem period. CLSM provides a slightly superior reliability, but it should be reserved for basic studies and CVA should be used in routine forensic work.

INTRAMUSCULAR HEMORRHAGES IN BACK MUSCLES IN AGONIC DEATH

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Background: During the agony, in selected causes of death (hanging, drowning), the presence of intra-muscular hemorrhages in the back muscles was reported to be probably due to terminal convulsions. In this respect, these findings could provide some evidence that the subjects were alive during hanging or drowning. **Aim:** The purpose of this prospective study was to evaluate the rate of detection of intramuscular hemorrhages in the back musculature in agonic deaths using the back musculature dissection. **Methods:** Eighty autopsy cases were selected (agonic deaths and control cases). The back muscles were dissected layer by layer. The findings were sorted according to the location in six anatomical regions located in the back. **Results:** In the thirty-eight cases in which hemorrhages of the back muscles were found, nineteen victims died from natural causes, five from intoxication, five from traumatic lesions, seven from asphyxia (hanging, drowning or mechanical compression of the thorax) and two from hypothermia. The main findings of this study is that intramuscular hemorrhages in the muscles of the back, as described by Tsokos, are found to be frequently observed even in asphyxia in deaths by hanging or drowning. However, such findings contribute to providing the evidence of vitality of the observed lesions. In addition, we would like to highlight the added value of a systematic histological control of the macroscopically identified hemorrhages to differentiate pre mortem lesions from hypostasis.

POST-MORTEM CONTUSIONS DUE TO FORENSIC EXAMINING OF MECHANICAL EXCITABILITY OF THE MUSCLES – A CASE REPORT

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Soft tissue bruises are considered in forensic medicine as one of the fundamental evidence for a vital character of an injury. Searching for such findings is an important part of every forensic autopsy. Presence or absence of bruises can be a major argument in the evaluation of the final opinion. Therefore, the authors present a case, in which bruises undoubtedly occurred several hours after the death of the victim. The report presents the outcome of a forensic examination of the body carried out by an expert at the scene. A body of the deceased 58-year-old man was discovered in the afternoon in early March, in open area in the Małopolska region. A forensic pathologist evaluated the signs of death of the deceased at approximately 18 p.m. He diagnosed quite well developed rigor mortis of limb's muscles and the jaw, the presence of bluish-purple livor mortis, with localization corresponding to the body position, fading after pressure. The body temperature measured in the rectum was approximately 30° C (with the air temperature of 5° C). Subsequently, the forensic pathologist tested the mechanical excitability of muscle in a typical manner – he used a neurological hammer to hit both arms and both thighs. He reported the presence of myotonic bumps in the arm region, as a reaction to the hit. In two of those areas, within a short period, bruises became visible. Based on the examination, the expert estimated the time of death between 10:00-12:00 a.m. The autopsy of the deceased was performed the following day at the Department of Forensic Medicine, Jagiellonian University. The post-mortem examination revealed the presence of eight oval, red bruises with a brighter area in the middle parts of the arms and thighs, five of whom were accompanied by contusions of the subcutaneous tissue. Histopathological examination of tissue samples taken from these locations confirmed the presence of subcutaneous and even intramuscular hemorrhages. This case shows that in special circumstances, bruises can occur as a postmortem artifact during external examination of the body. **Keywords:** bruises, skin, subcutaneous tissue, vitality signs, postmortem examination

NEW REFERENCE TABLES FOR PREDICTED HEART WEIGHT

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Background: Knowledge of normal heart weight ranges provides important information for pathologists. Comparing the heart weight to reference values is one of the key elements used to determine if the heart is pathological, as heart weight increases in certain cardiac pathologies. Current tables are outdated and were established on different populations. **Aim:** The purpose of this study is to establish new tables relevant to the local population, and to determine the best predictive factor for normal heart weight. We also aim at providing technologic support to calculating the predictive normal heart weight. **Methods:** The reference values are based on a study including 288 adult patients without any obvious pathologies who were autopsied in western Switzerland from 2007 to 2011. The statistically analyzed parameters were age, gender, height, body weight, BMI and body surface area. **Results:** Heart weight is statistically correlated with all of the parameters studied. Body surface area is the best predictor of normal heart weight. **Conclusion:** New reference tables for predicted heart weight are presented, as well a web application that allows for a comparison of heart weights observed at autopsy with the reference values. This application can also calculate BMI and body surface area.

EARLY MARKERS OF MYOCARDIAL ISCHEMIA RELEVANT TO FORENSIC PATHOLOGY: A NOVEL GENE EXPRESSION ANALYSIS SYSTEM COMPLEMENTARY TO IMMUNOHISTOCHEMISTRY

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Introduction: Post-mortem diagnosis of acute myocardial ischemia represents a current challenge for forensic pathologists, especially when death occurs within a short period of time (several minutes to a few hours) after the onset of the ischemic injury. Recent studies have investigated, at the immunohistochemical level, some markers that accumulate in or leak from the human cardiomyocyte after the ischemic event. Nevertheless, these markers are not detectable in the very early phase of myocardial ischemia. In this investigation, we wanted to test, under experimental conditions, the diagnostic potential of some immunohistochemical markers for the detection of early myocardial ischemia. Among them, we investigated: troponin I and T, myoglobin, fibronectin (total and tissular), tenascin C, C5b-9, connexin 43 and Jun B. The same and additional markers (such as HIF-1 alpha, caspase 3, 8 and 9) were studied at the gene-expression level as well, using the NanoString nCounter® gene-expression system. **Materials and methods:** A rat model of myocardial ischemia (ligation of the left anterior descending coronary artery, LAD) was used. The immunohistochemical and gene-expression investigations were performed on the ischemic myocardium at different time points after LAD ligation, ranging from 5 minutes to 2 weeks. As a comparison, hearts from control and sham-operated groups were investigated by the same methods. The NanoString nCounter® is a novel gene-expression system, which allows for direct measurements of mRNA expression levels without enzymatic reactions or bias, with a sensitivity coupled with high multiplex capability and a digital readout. **Results:** The earliest expressions following myocardial ischemia were observed for JunB (15 minutes) as well as for apoptosis and hypoxia markers (15-30 minutes), followed by total fibronectin (≤1 hour), C5b-9 (≤1 hour), myoglobin (≤1 hour), troponins I and T (≤1 hour).

The latest markers, expressed only in the healing phase of myocardial infarction, were tissular fibronectin and tenascin C. Conclusions: We have identified, by means of immunohistochemical and gene-expression investigations performed in a purely experimental model of myocardial ischemia, early markers of ischemic injury as JunB and apoptosis effectors, expressed as early as 15 minutes after coronary artery ligation in rats. Moreover, we have confirmed the early expression of total fibronectin, C5b-9, myoglobin and troponins (≤1 hour). We have, therefore, identified a panel of markers to be further applied in routine forensic practice in order to improve the diagnosis in the challenging cases of sudden cardiac deaths.

FREQUENCY OF CLASSIC AND STIMULANT-TYPE DESIGNER DRUGS AMONG SUSPECTED DRUG USERS IN CSONGRÁD COUNTY (HUNGARY) IN 2012

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Introduction: The aim of the present work was to obtain a real picture of the frequency of stimulant-type designer drug consumption in Csongrád county (South-East Hungary) in 2012. Urine and/or blood samples of suspected drug users taken by the police were analyzed for 16 classic illicit drugs, 10 psychoactive substances and 42 stimulant designer drugs. **Method:** The analysis was performed in samples collected from 332 persons (urine: 328, blood: 27) by GC-MS without immunological prescreening. **Results:** In the population investigated, 201 men (60.5%) and 27 women (8.13%) (total: 68.7%) were positive for at least one substance; the average age of the positive cases was 26.8 years. Similarly as in the preceding years, THC was the most frequently used illicit drug (124 positive samples, 37.4%), followed by the classic amphetamines (52, 15.7%), illicit opiates (10, 3.01%), medical opiates (10, 3.01%), and cocaine (5, 1.50%). 111 persons (33.4%) were positive for stimulant-type designer drugs, among which penthedrone showed the highest prevalence (72, 21.7%), followed by 4-fluoro-metamphetamine (4-FA, 7 cases, 2.11%), 4-methyl-amphetamine (4-MA, 6 cases, 1.81%), mephedrone (4-MMC), 3-fluoro-amphetamine (3-FA), and 2-methylamino-1-phenyl-1-pentanone (APVP) (4-4 cases, 1,24 % of each). The measured prevalence of benzodiazepines was 163 (49.1%), among which clonazepam (35, 10.5%) and alprazolam (26, 7,83%) showed the highest frequency. **Discussion:** Until the end of 2010, mephedrone was the "leading" stimulant-type designer drug on the Hungarian black market, but after it was entered into the list of illicit drugs, its frequency dramatically decreased. Among the 42 stimulant-type designer drugs seized by the police until April 2013, penthedrone was the most frequently used in Csongrád county in 2012. The majority of drug users were male (60. 5%) at an average age of 27 years. In the majority of cases, designer drugs were present in combination with each other, or with illicit and licit drugs, what can lead to more severe toxic effects than when they are used singly.

PRELIMINARY RESULTS OF POST-MORTEM MEASUREMENTS OF 3-BETA-HYDROXYBUTYRATE IN LIVER HOMOGENATES

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Introduction: The detection of drugs in samples collected during autopsy can be challenging as compared to clinically derived specimens. The presence of putrefactive compounds and the decomposed nature of the samples limit the direct applicability of clinically validated assays in a post-mortem setting. Tissue samples obtained from the liver are often used in post-mortem toxicology analysis in case of

blood unavailability. The aim of this study was to investigate beta-hydroxybutyrate levels in blood and liver samples in a series of medico-legal autopsies that included cases of diabetic ketoacidosis and bodies presenting decompositional changes. **Material and methods:** The concentrations of beta-hydroxybutyrate in femoral blood and two liver samples were retrospectively examined in a series of medico-legal autopsies (48 cases) including diabetic ketoacidosis (8 cases), non-diabetic individuals presenting with moderate to severe decompositional changes (20 cases) and non-diabetic individuals without decompositional changes (20 cases). The objective was to characterize beta-hydroxybutyrate concentrations in two liver homogenates in comparison to blood levels, as well as to evaluate the usefulness of beta-hydroxybutyrate determination in liver samples in order to quantify the metabolic disturbances potentially leading or contributing to death. **Results:** Beta-hydroxybutyrate concentrations in liver sample homogenates correlated well with blood values. Additionally, decompositional changes were not associated with increases in liver beta-hydroxybutyrate levels. **Discussion and conclusions:** Preliminary results suggest that beta-hydroxybutyrate can be reliably measured in liver homogenates when blood is not available at autopsy. Furthermore, these findings suggest that metabolic disturbances potentially leading or contributing to death may be objectified through liver beta-hydroxybutyrate determination even in decomposed bodies.

A CASE OF SUICIDAL INSULIN OVERDOSE – SIGNIFICANCE OF DIRECTED TOXICOLOGICAL AND HISTOPATHOLOGICAL STUDIES FOR MEDICO-LEGAL OPINION

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Introduction: The interpretation of insulin levels in the post-mortem biological material is very difficult. The number of published papers dealing with this problem is relatively low. The time of survival after insulin injection depends on many different factors and certainly influences the insulin levels detected in the post-mortem material. Unfortunately, in the forensic practice, we usually do not know that time, because the cadavers not infrequently are found after a long time since death, for example when the victim lived alone. Additionally, insulin determination in post-mortem blood, mainly because of ongoing thanatochemical processes, has a low diagnostic and testimonial value. **Case presentation:** A case of a 44-year-old non-diabetic man, who was found dead lying on the bed in his flat, is presented. Near the body, an ampoule and syringe were found and secured for further analysis. Two days earlier, the man had called his wife and said that he was going to commit suicide. The autopsy did not reveal the cause of death. The initial stage of putrefaction, blood fluidity, acute blood stagnation in the internal organs and two puncture marks on the right thigh, which might have been injection sites, were found. The standard toxicological analysis disclosed no evidence of drugs or alcohol, so, in keeping with the suspicion of suicide by insulin injection, a directed analysis with immunoradiometric assay (IRMA) was conducted. It revealed a high insulin concentration level in the vitreous humor (24.42 μIU/ml) and the presence of insulin in the material secured at the crime scene. All these analytical results, in addition to low amounts of glycogen in the liver (evaluated by the Periodic Acid-Schiff staining) confirmed insulin overdose. **Conclusion:** In cases where suicide by insulin poisoning is suspected, determination of its concentration in the vitreous humor and non-biological material using the IRMA method gives the opportunity, similarly as the LC-MS/MS analysis, of objective confirmation of the poisoning. An analytically confirmed higher level of insulin in the vitreous humor plays an important and even a decisive role in structuring the final medico-legal opinion about the cause of death. A detailed histological examination, especially of the

liver, aiming at detection of morphological symptoms of hypoglycemia, should be always performed. The vitreous humor should be routinely collected and analyzed during autopsy in every case with an "insulin" background.

A REVISION OF MISTAKEN INTERPRETATION OF EXPERT REPORT IN A CASE OF ACUTE RADIATION SYNDROME IN AFFECTED WORKERS AFER AN INDUSTRIAL ACCIDENT

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We present a case of an industrial accident, in which a container with radioactive waste exploded in consequence of a human error. Five workers were affected; all the victims developed acute radiation syndrome. The victims were initially treated at the Military Hospital in Sofia and then were transported for continued therapy to France. The oldest victim was 75 years old and suffered from preexisting diabetes mellitus; the patient manifested arrhythmia and therefore had a pacemaker implanted. After intensive treatment in France, when their lives were no longer at risk, the patients were transported back to Bulgaria and again hospitalized at the Military Hospital in Sofia. Four of the affected workers survived and fully recovered, but the oldest patient with pacemaker died. At the autopsy, according to the involved forensic pathologist, evidence of myocardial infarction was found; thus, he concluded that the cause of death was not related to the industrial accident. Under Bulgarian legislation, there were five workers exposed to temporary danger to life as a consequence of their developing acute radiation syndrome. A controversial issue was the fifth victim who died. We were appointed to a forensic examination board consisting of medico-legal doctors, a pathologist, radiologist and hematologists. Despite of the professional dispute concerning the association between the myocardial response due to prolonged severe ischemia and radiation loading during the body`s exposure, after a careful analysis of all medical records and histological examination slides, we inferred that - as a result of radiation and increased permeability – the victim developed acute coronary circulatory disorder which, when combined with preexisting diabetes, led to death. Our expert standpoint was opposed to the originally given opinion. Namely, we believed there was a direct and continuous causal relation between the accident and death of the victim. Thus, an incorrect conclusion to be pronounced by the prosecution was prevented and a crime associated with a loss of life of one of the victims was disclosed.

RIOT CONTROL AGENTS, IS IT SAFE AND IS IT LEGAL IN CONTEMPORARY CASES, SUCH AS IN TAHRIR SQUARE OR OCCUPY WALL STREET DEMONSTRATIONS

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The employment of toxic chemicals, such as pepper spray or tear gas, by security forces during violent confrontations and in armed conflict continue to be a source of legal and political uncertainty and concern.

There is concern that riot control agents (RCAs) and incapacitating agents (ICAs) are or could be misused as a method or warfare or for hostile purposes. On 19 November 2011, a disturbing video of Occupy Wall Street protesters at University of California, Davis, getting pepper sprayed by the police while passively sitting on the ground made the rounds on the Internet. The day after, the news' focus was on the Egyptian police firing tear gases at Tahrir Square demonstrators. The most dramatic example is the 23 October 2002 domestic use of toxic chemicals by Russian security forces when they used

a fentanyl derivative against some 50 Chechen terrorists who had taken approximately 800 hostages at the Dubrovka Theatrical Centre in Moscow.

As a result all the terrorists were killed, but at least 125 hostages died from the effects of the gas. What we know about RCAs It is widely claimed that RCAs have higher safety ratios. However, it is not always the case for two reasons. First, RCAs must act quickly before targets can react with defensive or offensive action, for this reason RCAs are used in higher doses. Secondly, like any other pharmaceutical agent, a population shows a considerable variation in sensitivity to RCAs effects, such as asthmatics or sickle cell trait patients. So vulnerable people may suffer from permanent injuries as well as may die with much lower doses of RCAs compared with general population. RCAs, such as CN, CS and OC, have been shown as contributory factor in some lethal cases.

What needs to be done? It has been shown that RCAs have been contributory factor number of deaths since 1960s. In order to have greater understanding the mechanism of deaths caused by RCAs and also for preventing more deaths, detailed autopsy guidelines should be applied on the suspected deaths. Although Minnesota Protocol (Model Protocol for a legal investigation of extra-legal, arbitrary and summary executions) can be used for these cases, improving a new and unique protocol will be more appropriate. Forensic medicine should play a central role in the analysis and prevention of death or injuries caused by RCAs.

A LECTIO MAGISTRALIS IN POLICE DEPARTMENT: THE SERIAL KILLER – TO BE OR NOT TO BE?

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The aim of this study is to analyze the behavior of serial killers from the perspective of criminology. **Method:** through a detailed analysis of two important models of Italian killers, two polyhedral paradigms, we followed the "red line" that begins at the hypothetical pattern of a serial killer, but ends with different patterns of the two analyzed criminal minds. **Conclusion:** our study reveals real difficulties faced by the policemen during their fight against criminal subjects and different variations of the criminal mind that entail an improvement and new mental horizons for detectives employed by the Police Department. **Key words:** Killer, Paradigm, Criminal Minds, Police, Detective

CO-MORBIDITY WITH SEXUAL ASSAULT: A CASE REPORT

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Co-morbidity or the co-occurrence of mental disorders and substance use disorders is common among victims of sexual assault, but occasionally, life threatening conditions have been observed in these patients, which need immediate medical attention. A 7-year-old girl was referred from a health care center to Sinawe with a history of sexual assault by an unknown male having occurred 4 days previously. She was threatened with death in case of disclosure. Her aunt suspected some incident must have happened as her gait was abnormal. Then the girl opened up and recounted the entire incident. She presented with vaginal discharge, vomiting and diarrhea along with mild fever. She was also depressed. On physical

examination, genital injuries with a hymen rupture were confirmed. She presented with abdominal muscle guarding. The patient was referred to a pediatrician at the Nelson Mandela Academic Hospital for exclusion of any morbid condition. The girl was refused admission as she was labeled a victim of rape, but persistent persuasion of the Sinawe Staff resulted in her being admitted and later on operated on for acute appendicitis.

PALM OF HANDS, A NEW CLINICAL SIGN DURING MEDICO-LEGAL EVALUATION OF FATAL FLAME BURN INJURIES

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The present prospective study was performed on 221 cadavers who were victims of burns, including those that died at the scene (8/221), among them two victims with non-vital burns (post mortem burns), and those deceased as inpatients (213/221). Those cadavers were examined and dissected in the Sulaimaniyah Medico-Legal Institute from May 8, 2008 to May 7, 2009, following complete medical history taking from relatives, interviewing responsible police station registration officers and obtaining data registered by burn centers. The age, sex, occupation, marital status and place of burn were taken into consideration in order to determine the distribution of age, sex, social status and specific geographical distribution. In general, the victims were either received from the scene after an average period of 2-4 hours following the event, or directly from hospitals. Predictions of the mode and manner of death based on primary information obtained from the families of the victims and from police registration officers were followed by the final manner of death determinations based in each case on the ruling by the court and prosecutor. Deaths from burns have been remaining at the top of the police list of casualties for the last 5 years in the Sulaimaniyah Medico-Legal Institute. • Young age was associated with higher mortality rates as compared to other age groups, what points to the most active stage of life, and the ratio of females to males was 6.4:1. • Housewives and girls accounted for more than 60% of deaths. • The incidence of burns showed a higher rate in rural as compared to urban communities and the ratio was 4.1:1. • More than 23% of suicidal burns involved students of intermediate and secondary schools. • Kerosene as a causative burn agent accounted for 86.4% of cases. • The manner of burns as revealed by family interrogations was 74.7% accidental and 25.3% suicidal, which means that suicidal burns represented one-quarter of deaths. On the other hand, the manner of burns as disclosed by police investigations, court and prosecutor decisions was 71.5% accidental, 27.6% suicidal and 0.9% criminal. • A part of the palm of the hands remained intact in all suicidal burn cases, while the palms were destroyed in all accidental burns.

HONOR CRIMES

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A man in charge, mostly the brother or the father, performs the act of killing based on an illegal relationship with a female in the family. According to a retrospective study done by a team from the Ministry of Human Rights and the Medico-Legal Institute in Baghdad, 2334 victims were killed in the past three years in consequence of honor crimes (including crimes exacted for revenge of honor). Numerous presentations demonstrate the manner of committing homicide under the name of honor crimes: classic cases, claiming loss of virginity, delayed crimes, concealed crimes.

TO DIE TOGETHER

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Introduction: In the praxis of forensic pathologists, we sometimes meet with the cases of mutual deaths or deaths that are somehow linked together. In this work, we present three cases of common deaths, when the perpetrator of homicide committed suicide within a short time after his malefaction. **Methods:** We present three unusual cases of duplex violent deaths, which are special not because of the category or cause of death, but due to unusual circumstances that showed that in all of these cases, the perpetrator of a murder killed himself too - in one case, in a different manner and in two of these cases, in the same or similar manner he had used while murdering his victim. **Casuistics:** The first case focuses on a man who inflicted multiple stab wounds with a knife on his girlfriend and caused her death due to hypovolemic shock. In total, she had 19 knife wounds of the chin, neck, upper extremities, thorax and dorsum. After her death, the perpetrator committed suicide by crashing his car against a concrete wall. The second case describes a Bulgarian couple which was found hanged in their garage. The circumstances at first suggested that it was a common simultaneous suicide; however, the precise external and internal examination of the corpses during the autopsy showed that the woman was murdered by her husband, who then completed the violent crime by his own death. The last case deals with a married couple that did not live together; the husband shot his wife while she was walking their dog and then turned the short arm gun against himself. **Results:** These three cases of common violent deaths were chosen to point out at the silent violence around us. In all of these cases, the violent crime was committed against the nearest person; however, in all of these three cases, the homicide was followed by remorse that led to suicide. **Conclusion:** The aim of this work was to demonstrate three different stories of joined deaths – the first one showed stabbing followed by a car crash suicide, the second one dealt with a simultaneous hanging that turned out to be a homicidal hanging followed by a suicidal hanging, and the last one focused on a homicide-suicide attack with a short arm gun involving a married couple. By choosing these three cases we want to point out at desperate situations of certain individuals that eventuate in mutual death – a homicide followed by suicide.

POSTER PRESENTATIONS

DEVELOPMENT OF THE AUTOPSY RATE IN SLOVAK REPUBLIC

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Introduction: The role of autopsy in the system of quality assessment in health care and in establishing the cause of death in the so called non-treated population and in cases of violent deaths is irreplaceable. Over the last decades of the 20th century and the first decade of the 21st century, we have been witnessing a decreasing autopsy rate at global, European and national levels. The objective of this paper is to explain a recent development and current situation of autopsy rate in Slovak Republic. **Material and methods:** An analysis was performed of the development of the autopsy rate in the years 1995 - 2011. The statistical data for the purpose of the analysis were acquired from the Statistical Office (SO) and the Health Care Surveillance Authority (HCSA). **Results:** The autopsy rate decreased in the years 1995-2004 from 18.3% to 12.5% (SO). In the years 2005-2011, according to SO it ranged from 16.5% to 12.5%. According to the data from the HCSA, the autopsy rate in the above-mentioned period ranged from 18.1% to 14.2%. The number of medico-legal autopsies in absolute numbers decreased from 4,438 to 4,077. In comparison with the numbers of pathologic-anatomical autopsies, there was a relative increase of the rate of medico-legal autopsies. The number of autopsies associated with expert opinion formulation slightly decreased. **Conclusion:** Detailed studies of the autopsy rate show an increased number of diagnostic discrepancies with a decreased autopsy rate. In spite of the fact that in Slovak Republic there has been established a new institution that centrally manages performing autopsies, the current situation in this field shows that a decreasing tendency of autopsy rates is progressive and permanent also in the Slovakia region. **Key words:** autopsy – autopsy rate – pathology – forensic medicine – Health Care Surveillance Authority

EPIDEMIOLOGY OF MORTALITY IN THE HOMELESS UNCLAIMED POPULATION: A RETROSPECTIVE RESEARCH

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Introduction: India is one of the fastest growing economies in the world today, but it is seen worldwide that where there is rapid growth, there are people in abject penury being left behind homeless in the streets. Homelessness significantly impairs physical health and increases mortality. Data from the National Crime Records Bureau of India reveals that 2,22,446 bodies were declared unidentified in the past six years, i.e. 102 persons are dying unidentified every day in India. The aim of this study is to estimate the number and magnitude, demographic characteristics, the causes and manner of death in the homeless unidentified population. **Material and Method:** This is a 5-year retrospective study (from January1, 2006 to December 31, 2010) based on the autopsy records of the Department of Forensic Medicine and Toxicology, Lady Hardinge Medical College, New Delhi. Almost all deaths among the homeless people were regarded suspicious and they were registered as medico-legal cases. **Results:** During the study period, a total of 2773 autopsies were conducted in the morgue of Lady Hardinge Medical College, New Delhi. Out of the total number of autopsies, 749 post-mortem examinations were performed in unidentified homeless persons. The highest number of 280 (37.38%) deaths was reported

in the year 2010. The homeless decedents showed a predominance of males, i.e. 676 (90.25%) cases. The majority of deaths occurred in the age group of 41–50 years (n=205 cases, 27.3%). Natural events constituted the cause of death in 536 (71.56%) cases and in the remaining 150 (28.43%) cases, the cause of death was related to an unnatural event. The cause of the majority of natural deaths in 387 (72.20%) cases was pneumonitis, followed by pulmonary tuberculosis in 122 (22.76%) cases. In cases of death resulting from unnatural events, the highest number of cases (n=91, 42.72%) were victims of road traffic accidents, followed by 63 cases (29.57%) of suspected poisoning. The highest number of deaths (61.54%) was reported between July and November. Out of the total 749 deaths, 700 (93.45%) victims were pronounced dead on arrival and only 49 (6.54%) individuals died in the course of treatment, having been admitted to hospital. **Conclusion:** The homeless people are vulnerable to exposure to natural cold, alcohol, drug abuse, violence, respiratory infections, etc. In view of the absence of public health surveys and epidemiological studies and lack of concern of health providers, we cannot assume the magnitude of their mortality. A large proportion of these deaths are preventable and public health interventions can save the life of the homeless population.

CHARACTERISTICS OF FATAL ROAD TRAFFIC ACCIDENTS IN BANJA LUKA REGION

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Introduction: Road traffic injuries are a large global public health and social problem. Every year, more than 1.2 million people are killed in road traffic accidents worldwide. Understanding the significance of that problem in a given local area is necessary for development of effective preventive measures. **Material and method:** In this retrospective study, the authors used data from 186 post-mortem examination records of road traffic accident victims autopsied at the Department of Forensic Medicine in Banja Luka in the period of 2010-2012. Blood samples for alcohol analysis were forwarded to the Forensic Unit, Ministry of Internal Affairs of Republic of Srpska, where they were analyzed by gas chromatography (Thermo Scientific, Focus GC). **Results:** Out of 186 road traffic accident victims autopsied, 160 (86%) were male and 26 (14%) were female. The two most numerous age groups were 20-29 years and over 60 years of life. Overall, the most common cause of death was head injury (45.7%). Drivers (32.3%) and pedestrians (28%) were the leading groups of fatally injured, with head injuries constituting the most frequent cause of death. The prevalent injuries of the drivers involved the thorax (83.3%), followed by the head (63.3%), abdomen (60%) and lower extremities (36.7%). The most commonly injured body regions among the pedestrians were the head (86.5%) and thorax (84.6%), followed by the lower extremities (52%), spine (48%), etc. In this study, in 55.4% of the drivers and 56.4% of the pedestrians, determinations disclosed legally impermissible blood alcohol concentration levels (over 0.3‰). **Discussion and Conclusions:** There was a predominance of male victims, particularly among the drivers. Of the 60 drivers killed, 58 were male. Head trauma was the most common cause of death. The majority of individuals at risks were drivers and pedestrians, predominantly suffering from head and chest injuries. Injuries of the head, spine, pelvic and lower extremities were more frequent in the pedestrians. Abdomen injuries were more common in the drivers. More than one-half of the drivers and pedestrians were under impermissible influence of alcohol at the time of accident. The results of this study are mostly in accordance with international literature, possibly except the excessive predominance of male victims.
Key words: Road traffic victims, autopsy, cause of death, body region injuries

21TH CENTURY METHODS APPLIED TO THE RECONSTRUCTION OF A 19TH CENTURY CRIME SCENE

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Introduction: Count Teleki Laszlo (1811-1861), a prominent politician and academic, was found dead in circumstances indicating suicide in his study-room on May 8, 1861. Count Teleki was one of the leading figures of the Hungarian independence movement during the revolution of 1848-49 and in the subsequent years. He died on the eve of an important speech concerning Hungarian independence he was supposed to give as a response to the king of Hungary of that time, Habsburg Franz Joseph I. The aim of the poster presentation is to reconstruct the crime scene with the help of original documents and 3D laser imaging, which has allowed for re-examining this historically significant and controversial death case. **Materials and methods:** Research and finding the relevant materials: One could gain relevant information on the above death case thanks to the fact that some fragments of photographs and documents of that time have been stored in archives and museums and preserved till now. A five-member team examined those historical documents generously provided by the Hungarian National Museum, which included the records of the crime scene investigation, photographs, the autopsy report, and also the report of chemical and ballistic experts. The level of forensic and ballistic knowledge of that age was taken into consideration in the course of the analysis of documents. **Results:** The starting point of our investigation was that – for the very first time in the Hungarian history of crime scene investigation and forensic science – stereo photographs were made at the crime scene in question. This extraordinary historical document allowed for producing a 3D reconstruction of the crime scene. At that time, the autopsy was conducted by Dr. Ferenc Flor, Chief Coroner of the City of Pest. The post-mortem examination revealed that the cause of death was a hemorrhagic shock resulting from a single shot to the chest. The autopsy also concluded the heart was beating when hit by the bullet. The bullet entered the body on its left side between the 5th and 6th ribs. This was in line with a supposed self-induced injury using a front-loading gun found next to the body. **Discussion and conclusion:** The 3D rendering of the crime scene revealed the position of the body and other objects in the room. The post-mortem examination made it clear that a single shot was fired at a close range, at an unusual angle of 45 degrees, from the upper-left side. This was not considered to be a typical angle for a self-induced gunshot injury, but could not be excluded either. No other injury was found on the body. The ballistic expert concluded that the shot was fired from that particular weapon found next to the body. Using the 3D method helped us in modeling the motion and situation of the human body in space; in consequence, we could reconstruct more precisely what had happened 150 years ago.

WHY IS IT STILL DIFFICULT TO DIAGNOSE DROWNING?

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According to the WHO statistics, drowning is the third most frequent accidental cause of death following traffic accidents and falls.

The aim of our study was to overview the demographic facts and diagnostic paths in 65 cases where the cause of death was considered drowning in Csongrád County, Hungary, in the years of 2007-2011.

Demographic data, police reports, pathological, and laboratory results were evaluated, the drowning index was calculated.

The descriptive statistical analysis of demographic data revealed that the number of male victims were double that of females, and nearly one-half of the deaths occurred in the age group of 41-60 years, while there was only one case under the age of five.

The main risk factors identified among men were high risk behaviors, being under the influence of alcohol and participation in water sports and leisure activities. Sixteen deaths were regarded as suicidal, one as a suspected homicide, two were ascribed to natural diseases, and the rest (46) were considered as accidental. Nearly one-half of the accidental victims were under the influence of alcohol.

There were no cases where all of the classical pathological signs of drowning could be seen at autopsy, while in five cases, none of the signs of asphyxia were described. The diatom tests were positive only in one-third of the corpses, though in the remaining cases, the absence of water samples originating from the immersion site interfered with the test.

We have concluded that calculating the drowning index is not a useful tool and the diatom test should be used as an indicative aid of drowning.

LETHAL INJURY WITH PARTIAL EVISCERATION DUE TO A DOG ATTACK

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Genital and anal injuries caused by canines are very rare and occur typically as a result of an animal attack or of zoophylia. We present an unusual case of an 88-year-old female who suffered an anal bite injury caused by her dog in her home and died shortly after having arrived to the local hospital. The forensic autopsy revealed one large perineal tissue defect surrounded by typical teeth marks, absence of other relevant external injuries, intact internal genitalia, destruction of the anus, rectum and sigmoid colon, partial destruction of the small intestine, massive bleeding in the surrounding tissues, as well as purulent bronchitis, pneumonia and arteriosclerosis. The authors review the literature and analyze the case of this strange animal behavior.

BIOCHEMICAL ANALYSIS OF METABOLIC MARKERS IN AUTOPSY

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Introduction: Poorly maintained or undiagnosed diabetes may cause severe metabolic disturbances, such as diabetic ketoacidosis (DKA) and hyperglycemic coma. Another significant cause of ketoacidosis is alcohol abuse, which causes alcoholic ketoacidosis (AKA). These conditions can turn out to be lethal when untreated. Diagnosing them as a cause of death in autopsy is not always possible based on macroscopic, microscopic and toxicological findings. A biochemical analysis of metabolic markers, such as glucose, lactate, ketone bodies and glycated hemoglobin (HbA1c) provides essential information in such cases. **Materials and methods:** Data from forensic autopsies performed in Finland were evaluated and six exemplary cases where the results reflected metabolic disturbances are presented and the results discussed. Biochemical analyses of samples from forensic autopsies were performed in the Laboratory of Forensic Biology (Department of Forensic Medicine, Hjelt Institute, University of Helsinki). Glucose, lactate and ketone bodies were measured in the vitreous humor and HbA1c was measured in EDTA-blood samples. **Results:** Representative cases of DKA, AKA and hyperglycemia were chosen based on the level of metabolic markers. In DKA cases, ketone bodies, Traub value and/or glucose level, as well as

HbA1c level were clearly elevated. In AKA cases, Traub value might be slightly elevated, but glucose and HbA1c levels were within the reference limits and ketone body level was elevated. In hyperglycemic cases, Traub value and/or glucose levels were elevated, but ketone body levels were within the reference limits. HbA1c levels were often elevated, unless hyperglycemia was very recent or the episodes were less than 12 hrs at a time. **Discussion and conclusions:** Elevated glucose and elevated sum of glucose and lactate levels, the so called Traub value, indicated hyperglycemia. Nevertheless, due to postmortem glycolysis, glucose values under the reference limit cannot be used to exclude hyperglycemia. Elevated ketone bodies are a sign of ketosis or ketoacidosis. HbA1c is a reliable marker of average antemortem glucose levels in the preceding 1-2 months. It is important in distinguishing if the cause of ketoacidosis is diabetes or alcohol. Due to postmortem changes in a sample matrix, it is important to have an appropriate method for analysis. A combination of metabolic markers, such as glucose, lactate, ketone bodies and HbA1c provides the forensic pathologist with significant information in support of the diagnosis of the cause of death.

SEVERITY OF MORPHINE INTOXICATION

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Case records of 198 inpatients treated in the intensive care units of Moscow city hospitals for acute parenteral opiate intoxication were studied. The mean age of the patients was 24.5 years (16-56 years); most of them were males (83.8%; 166/198). There were 35 (17.7%) females. By taking into account the high ability of heroin to cause physical dependence that develops on the average within 1.5-3 months of its intravenous injection, it can be stated that most of the examinees were chronic drug addicts. Blood toxicological studies of the inpatients (n = 198) for acute poisoning detected morphine (1.5 μg/ml (0.1-4.1 μg/ml)) in all the cases (100%). Forensic chemical studies of blood, urine, and viscera from those who had died from intoxication (n = 55) within the first 48 hours after admission revealed morphine only in the urine (4.4 μg/ml (0.06-12.0 μg/ml)) just in 58.2% of cases (32/55); in the remaining cases (41.8% of the 55 victims), toxicologically important substances were not revealed in all study media. The critical blood morphine concentration (LD50) is 0.98 μg/ml in females and about 1.2 times less (0.78 μg/ml) in males. The mean blood morphine level was 0.6 μg/ml (0.1-3.4 μg/ml) in victims below 25 years of age (n = 117) and 1.15 μg/ml (0.1-3.9 μg/ml) in those aged above 25 years (n = 81). Thus, the presented information may be used to make an approximate estimate of the risk of death within all possible blood morphine concentrations, by taking into account gender, age, and opiate tolerance. The foregoing suggests the necessity of performing a critical appraisal of the positive results of a forensic chemical study as evidence for fatal opiate intoxication, particularly due to the absence of unambiguous morphological equivalents of this pathology, and to the ambiguity of toxicological parameters in acute and fatal poisonings.

EVALUATION OF ROUTINE DNA TYPING OF FINGERNAILS CLIPPINGS AND SWABS

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Physical contact between two or more people can result in a transfer of DNA from one person to another and biological material can accumulate under the fingernails hyponychium. Debris under the nails is anatomically protected against contamination from exogenous material. This is one of the reasons why the detection of an additional DNA profile in this site can be of a great value in the reconstruction

of a violent case. DNA extracted from fingernail swabs of victims (as well as perpetrators) in forensic cases is a possible source of DNA from the perpetrator in cases where victims struggled or defended themselves. The source of this DNA under victim's fingernails could possibly originate from a contact with the perpetrator´s blood, saliva, semen or scratched skin. In this study, we have evaluated the relevance of routine DNA typing of fingernails clippings and swabs processed at the Department of Forensic Biology and DNA Analysis of the Institute of Forensic Science in 2011. The results are in concordance with outcomes of the previously published studies.

SEQUENCING DATA FOR HV1 AND HV2 MTDNA REGIONS IN MOTHER-CHILD SAMPLES

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Introduction: MtDNA analysis is relevant for forensic identity testing, as well as for human evolution studies. Due to maternal inheritance, lack of recombination, a high number of copies per cell, a high mutation rate and high polymorphic density, the mtDNA hypervariable regions HV1 and HV2 are well suited for forensic identification using a maternal relative as a reference sample. **Materials and methods:** In order to determine the frequency and the type of mutation between two generations, we investigated uniparental mtDNA inheritance in 50 mother-child pairs through the analysis of the HV1 and HV2 sequences. **Results:** Preliminary results show that most maternal relatives share identical mtDNA sequences and the neomutation rate seems to be very low from one generation to another. These data confirm the importance and the utility of mtDNA, allowing for a comparison of family members who share a common matrilinear ancestry and providing the basis for identification and maternal relationship both in biological evidence and in living individuals.

THE GENE EXPRESSION CHANGES AFTER CHRONIC ALCOHOL TREATMENT IN MOUSE SKELETAL MUSCLE WITH WHOLE TRANSCRIPTOME SHOTGUN SEQUENCING

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Introduction: Alcohol is one of the most widely used drug substances in the world. Repeated administration of alcohol causes various physical or mental disturbances. There are many reports concerning skeletal muscle impairment related to alcohol, such as striated muscle dissolution and muscle atrophy. Although the mechanism of the relation between alcohol and the muscular diseases has not been cleared yet, it is suspected that repeated administration of alcohol might change some genes in the skeletal muscle. In this study, we investigated the transcriptome in the skeletal muscle after the repeated alcohol administration in mice. **Materials and methods:** Mice were treated with 3.5 g/kg ethanol (n=2), and saline as the controls (n=2), four times daily for a week. The iliopsoas muscle was collected at 8 hours after the final injection, and total RNA was extracted and mRNA was purified. We used Miseq (Illumina) to investigate all RNA sequences according to the manufacturer`s instruction. The obtained reads were mapped to reference RNA sequence using Bowtie software, and differential expression was assessed using DESeq which was an R package. **Results and discussion:** In all the samples, over about 3,000,000 reads were obtained each, and over 90% were mapped to the reference sequence. Over 43,000 genes were expressed in each sample. Compared with the control, the expression of 34 genes increased, and that of just 1 gene decreased in alcohol-treated mice. The increased genes were related to inflammation, such as chemokine ligand 6, CD14 and C3, what suggested that change of the expres-

sion concerning immune system might occur in mouse muscle after alcohol treatment. The decreased gene was ladybird homeobox homolog 1, which is required for muscle precursor migration and whose lack is manifested as an extensive loss of limb muscle in mouse. Our results indicate that the reason that chronic alcohol intake leads to muscle atrophy could be explained. We intend to analysis these genes and clarify the pathophysiology of muscle disturbances after repeated alcohol administration.

INTRODUCTION TO EXPRESSION OF SSTR4 IN MOUSE PITUITARY GLAND AFTER CHRONIC STRESS

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Introduction: Recently, death from overwork has been a focus of attention as one of the serious social problems in Japan. People who die from overwork must suffer from chronic stress. It is important to diagnose chronic stress to demonstrate death from overwork in forensic practice. Unfortunately, forensic pathologists do not have at their disposal any useful tool or marker to achieve the purpose. Although stress induces glucocorticoid (Gc) secretion from the adrenal glands, there is a huge variance of Gc levels in blood of the deceased due to the stress of agonal stage, and the hormone may not be available for forensic practice. We already reported that the somatostatin receptor 4 (Sstr4) increased after high-dose Gc treatment in pituitary adenoma cells (Kwashima et al. 2010). We examined Sstr4 expression under various stress intensities and durations, including chronic, in mouse pituitary glands as a preliminary study. **Materials and Methods:** 5,7 and 9-weeek-old male BALB/c mice were individually subjected to 1 h or 8 h/day of restriction stress for 1 day or 1 week. No restriction was employed in the controls. The mice were euthanized at 60 minutes after the final treatment and the pituitary glands were collected. The levels of Sstr4 mRNA from the gland were measured with the q-PCR method. **Results and discussion:** There was no significant difference in Sstr4 with a single and chronic 1h-treatment. Sstr4 in 8 and 10-week-old mice after a single 8h-treatment showed a significant decrease, but no such phenomenon was seen in animals subjected to chronic treatment. In 6-week-old mice subjected to the same treatment, there was a significant decrease of Sstr4 as compared to the controls and no significance was observed between single and chronic treatment protocols. We demonstrated that Sstr4 expression only decreased after single and intensive stress. Therefore, evaluation of Sstr4 might be useful in diagnosing the degree and duration of stress in forensic practice.

LEGAL OUTCOME OF SEXUAL ASSAULT CASES IS INFLUENCED BY ASSAILANTS' SOCIOECONOMIC STATUS: A REVIEW OF RAPE CASES OCCURRING IN EASTERN CROATIA OVER 33 YEARS

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Aim: The present study aimed to investigate whether socioeconomic status (SES) of the assailant influences the legal outcome of the sexual assault case. **Materials and Methods:** This retrospective study

investigated judicial records of 178 closed cases where charges of sexual assault had been pressed in the District Court in the region of Eastern Croatia over 33 years (1973-2006). The records included information on assailants, victims and legal outcomes. Legal outcome, education and employment status were binary-classified (imprisoned or not; less than 11 vs. 11 or more years of formal education; and employed/receiving education vs. unemployed/retired, respectively). **Results:** Less educated assailants constituted the majority (65%) of perpetrators. Imprisonment was more probable if the assault had happened at a public or at the victim's place and less probable if it happened at the assailant's place (66%, 67%, and 35%, respectively; p = 0.025). The regression model based on the assailant's educational level, employment status and previous criminal history was statistically significant (2 (df=3, N=114) =9.912, p=0.019). The model explained between 8.3% (Cox and Snell R square) and 11.4% (Nagelkerke R square) variation in legal outcome of the sexual assault case and correctly classified 71.1% cases. The assailant's education level was an independent variable that significantly contributed to the model (p=0.010), implicating that the less educated assailants were 3.1 times more likely of being imprisoned than the more educated assailants. **Discussion:** The estimation of the individuals' SES in this study was based on educational and employment status, while other contributive factors (income, occupation and wealth) could not be established from the reviewed data. We have found that in cases where it seemed that the crime with similar circumstances was committed, according to all the available data; the legal outcome was influenced by the assailant's SES and previous criminal history. These results are in line with the Black's theory (Bouffard et al., 2000), predicting that in an assault case committed by those of a higher social status against those of a lower social status ('downward' crimes), the law is less penal. We assume that assailants with a higher SES are perceived more trustworthy in the courtroom, leave better subjective impressions (based on the appearance and through interaction with the assailant) and can afford a (better) attorney. **Conclusion:** We have established that the assailants' educational and employment status are predictive of legal closure of a sexual assault case.

USEFULNESS OF ENTOMOLOGICAL METHODS IN FORENSIC INVESTIGATION – – A FORENSIC ENTOMOLOGY CASE FROM THE PRACTICE OF DEPARTMENT OF FORENSIC MEDICINE IN KATOWICE, POLAND

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Introduction: Arthropods, mainly insects, found on cadavers or at the crime scene provide priceless evidence (entomological traces), which may be successfully used by legal authorities. Knowledge about bionomics of necrophilic insects, the foundations of taphonomy and thanatology allow the entomologist for performing the role of a forensic specialist. Forensic medicine increasingly more often benefits from the achievements of biological sciences, especially forensic entomology. **Case presentation:** The corpse of a 55-year-old man was found 100 meters from the forest; his head was partially immersed in water. He was dressed, so only the head was available for insects. It was covered with eggs and larvae at different age. Also adult blowflies and beetles were present on the body. The autopsy showed that the cause of death was multiple gunshots to the head and the chest. To determine the time of death/the corpse's presence at the scene, an expert opinion of a forensic entomologist was commissioned. Samples of eggs, larvae, photographs from the crime scene and autopsy, and of course meteorological data from

the nearest weather station were sent to the specialist. The entomological-morphological analysis of samples revealed: eggs of Calliphoridae family, first instar larvae of Lucilia sp. and second instar larvae of Lucilia caesar (Linnaeus, 1758), which were the most numerous. However, specific developmental data for this species were not available. As an alternative, developmental data for the sister species, Lucilia illustris, were used. Minimal accumulated degree-hours (ADH) was calculated at 537.6 (46-47 hours), maximal – 772.8 (68-69 hours) and mean at 655.2 (55-56 hours). Thus, the minimal post mortem interval (PMI) was estimated at 55-56 hours. **Conclusion:** In the case of a cadaver found at the stage of late post-mortem changes, such as putrefaction, forensic entomological analysis of the arthropods present on the body may be really helpful for legal authorities, especially in determining the minimal post mortem interval. Collection of representative samples of insects, photography of the crime scene and the cadaver and meteorological data are indispensable for formulating an optimal opinion by a forensic entomology expert.

USEFULNESS OF COMPUTED TOMOGRAPHY IN THE DIAGNOSIS OF METALLIC FOREIGN BODIES

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The use of computed tomography (CT) in forensic medicine has been on the increase in the past few years. One of the applications of this method, in classic medicine as well as in forensic science, is identification and localization of foreign bodies. From the everyday practice it is well known that in plane crash victims, the localization of the foreign body and estimation of its type may be crucial. Determining whether the foreign body is metallic or not, even in CT, may be problematic. The aim of the study was to evaluate the capability of CT in estimation the type of different metallic foreign bodies, particularly according to the sort of the metal. CT studies were performed in the Department of Forensic Medicine of Collegium Medicum in Bydgoszcz, using a 4-slice scanner in victims of accidents, as an element of standard forensic procedure. All acquisitions were performed of corpses placed in a container made of polyethylene, in which the body was transported from the scene of accident. Different metallic foreign objects, made of various types of metal were located beneath and on the body as determined with respect to adjacent air, bones and soft tissues. Their appearance, density in Hounsfield units and artifacts were evaluated. The acquisition was repeated without the container to compare if it affected the CT images. It was noted that images with and without the container did not differ. The authors present the images of various types of metallic foreign objects.

UNDERGRADUATE TEACHING ON INTERPERSONAL VIOLENCE AND FORENSIC MEDICINE

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Introduction: "Interpersonal violence" is a term that encompasses sexual assault, rape, elder abuse and domestic abuse. All doctors, regardless of grade and specialty, will come into contact with patients who may have an abusive history – either acute or historical. However, most UK medical schools provide

little or no teaching on the issues surrounding interpersonal violence or forensic medicine. An education project was developed which aimed to equip medical students with an understanding of these topics, have confidence in managing presentations, and gain an awareness of referral pathways that are available for patients. **Method:** A questionnaire was developed to gauge the base level of medical student knowledge. Teaching for clinical medical students was then designed and piloted. Video lectures were recorded, discussion cases were added to the curriculum and resources were made available for further learning. **Results:** Students gave overwhelming positive feedback to the project. Many indicated that it will influence their future clinical practice, and has served to dispel myths and stereotypes that they had previously held. **Conclusion:** In busy medical curricula, it is often hard to find space for additional teaching on "new" topics. However, teaching can be successfully provided in a variety of ways, so that important topics can be covered concisely and effectively. Interpersonal violence can affect patients both psychologically and medically. An awareness of these issues is essential for all doctors, regardless of specialty.

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