An unusual fatal injury due to tyre blast
An autopsy case

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Abstract: Injuries caused by exploding tyres during servicing can be seen as direct injuries caused by metal rim fragments and barotraumas as a result of high pressures. This destructive potential has received little attention in the medical literature. It has implications in terms of workplace safety as well.

An 18-years old mechanic was fatally injured by exploding of the tyre during servicing. The pressure generated during inflating a truck tyre struck the tyre directly to the chest and abdominal region of the victim, and the victim had also been blown to the nearby mirror of the lorry. He died upon admission to emergency. Medico-legal autopsy showed multiple internal organ lacerations and rupture of the aorta.

Key Words: trauma, tyre, blast injuries, tyre-blast injuries, aort rupture, autopsy.

A different category of blast injuries is the one related with exploding tyres. Injuries caused by exploding tyres can be seen as direct injuries caused by rim fragments and barotraumas as a result of high pressures [1].

Though, the destructive potential of the tyre explosions has received little attention in the medical literature, fatal and severely deforming injuries have been reported. These severe injuries have been reported mainly during the servicing of big tyres [2, 3]. Most of the tyre explosions take place during the servicing either road side or at service stations [4]. The size of the tyre, the amount of the pressured air and the distance between the tyre and the victim are the factors determining the severity of trauma [3].

In a study reviewing English literature on tyre blast injuries, a total of 763 patients were analyzed. Most of the patients were young aged male mechanics and the explosions were usually occurred during tyre servicing particularly during inflation. The head and face were the most commonly affected regions (48 %), followed by the upper limbs (20 %). Multi trauma was in about 25 % of the patients. The overall mortality was high (19 %) and was mainly caused by head injuries.

We present a young mechanic case who is the victim of a fatal tyre blast incident at the service station.

CASE REPORT

An 18-years old mechanic was fatally injured by exploding of a truck tyre while inflating at service station. The air pressure generated at the time of explosion, the tyre had been struck to the chest and abdominal region of the victim, and the he had also been blown to the nearby mirror of the truck. He died upon admission to emergency.

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After examination of the body at hospital Morgue by prosecutor and medical doctor, the body was referred to ATK (Council of Forensic Medicine) for medico-legal autopsy (Figs 1 and 2).

**AUTOPSY FINDINGS**

The body was that of a young male, with rigor mortis present all over the body. Post-mortem lividity was present on the back and dependent parts of the body in supine position. Multiple abrasions of varying sizes were present on the medial aspect of upper one-third of the right arm, sternal region of the chest, whole right side of the chest extending from right axillary region up to the right hip region. A lacerated wound of size 1.5 cm x 1 cm was present on the occipital region of the head (Figs 3, 4).

On internal examination, there was no skull fracture and brain hemorrhage. Right and left hemothorax (1100 ml and 1600 ml blood respectively), multiple lacerations in both lungs, complete rupture of thoracic aorta at the level of 5th Thoracic vertebra (Fig. 5), liver lacerations and retroperitoneal hemorrhage were the major findings. There were serial fractures of right 1 to 5 ribs, and left 3 to 4 ribs at different lines.

Toxicological screening of the samples obtained during autopsy revealed no presence of alcohol and licit/
illicit drugs. Internal hemorrhage resulting from rupture of Aorta and lacerations of internal organs was the cause of death.

**DISCUSSION**

Pneumatically induced injuries of this kind are very rare and also not frequently seen in forensic literature [1]. The high energy released by large blasts can result in severe injuries. This type of work-related injury is underreported, and for this reason the forensic literature may lack this kind of fatalities.

In the case reported here, the mechanics had been engaged in inflating the tyre for repair, when the fatal event occurred. He had been standing in front of the tyre and was inflating it. After the explosion, the sudden release of highly pressured air shot him and he was thrown back against the truck, the mirror of the truck stroke his head. Fatal chest and abdominal wounds were the fatal results of this tyre explosion.

In such a case of large tyre blast, three types of injuries can be expected: primary, secondary and tertiary injuries. The primary injury is resulted from the initial pressure wave (shock wave). This shock wave can cause severe barotraumas to the eye and damage to air containing organs [5, 6]. This trauma was responsible for the lung great vessel liver lacerations in our case. Secondary injuries are caused by flying objects fragments materials propelled by the blast such as rim and ring. Tertiary injuries are caused by falling striking of the body to ground and other nearby objects [5, 6]. The lacerated wound at occipital region of the head of our case was resulted from tertiary effect.

Inflated large tyres contain a tremendous amount of potential energy and tyre blast injuries during servicing have a high morbidity and mortality. Preventative occupational measures should be implemented.

Acknowledgment. A part of this article presented at 22nd Congress of the International Academy of Legal Medicine Istanbul, Turkey, 2012.

**References**

Forensic Medicine
Fundamentals and Perspectives

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Springer Hiedelberg New York Dordrecht London
ISBN 978/3-642-38817-0. ISBN 978-3-642-38818-7 (eBook)
DOI 10.1007/978-3-642-38818-7.
Library of Congress Control Number: 2013949476

The book „Forensic Medicine“ was written by two Forensic Pathologists (R.B.D and M.A.V) and one Forensic Toxicologist (H.F.S), specialists in their field and working in Institutes of Pathology and Forensic Medicine in Germany since decades.

Their work with 30 chapters starts with an introduction, describes the external postmortem examination, questions of thanatology, autopsy and exhumations as well as those of establishing identity and the role of vital reactions (chapters 1 to 7). Next chapters are written with regard to special forms of violence, e.g. blunt force trauma, pointed, sharp, and semi-sharp trauma, gunshot and blast wounds, neck trauma, thermal injuries, electricity, lightning and gases, deaths due to asphyxia, water-related deaths, death by starvation and dehydration (chapters 8 to 18). Special chapters concern forensic examinations of living persons as victims of violence (domestic and family violence) which means the Clinical Forensic Medicine as part of the daily work, particularly child abuse, child sexual abuse, infanticides and neonaticides (chapters 17 to 20). The chapters 21 to 24 - traffic medicine, forensic DNA analysis, forensic osteology and forensic radiology – also describe all important questions and findings with special regard to new developments.

As there are a lot of very special problems in the field of forensic medicine, these points were summarized in chapter 25: e.g. deaths in police custody, in Inpatient Psychiatric Institutions, in prison, in private homes, in the bathroom, during sports and sexual activity, pregnancy-related deaths, fatal occupational accidents, discovering multiple bodies, followed by a chapter for deaths in alcoholics and drug users. Additionally, the wide spectrum of sudden unexpected natural deaths includes the most important diseases leading to sudden death with often an unusual death scence (myocardial infarction, myocarditis, cardiomyopathies, vascular causes of sudden death, diseases of endocrine organs etc.). Also the most important aspects in cases of suspected sudden infant death syndrome are described in detail. A special chapter 26 was written to present international norms and institutions against torture, forms of torture (physical and psychological) and physician participation in torture.

While chapter 27 concerns the forensic psychopathology and scenarios requiring expert appraisals during criminal investigation and trial proceeding, chapter 28 deals with the role of forensic expert opinion in cases of medical malpractice, mentioning typical malpractice charges and proposing the structure of a forensic appraisal in medical malpractice claims. The last two chapters 29 and 30 – forensic alcohology and forensic toxicology – mention all problems and questions relevant during the daily work in detail: e.g. alcohol detection screening, toxicokinetics and toxicodynamics of alcohol, alcohol related histopathological findings and classifying poisonings with symptoms and syndromes, postmortem toxicology, analytical detection and determination methods, quality control and plausibility, medical drugs and other substances of particular relevance in forensic toxicology and traffic medicine as well as intoxications with further anorganic and organic substances, including doping agents and knockout drugs.

All chapters are well written and substructured, in total there are 369 figures and 163 tables within the thirty chapters and additional 32 tables and body charts for graphic documentation of injuries in the appendix. Just the tables include a lot of information and made it possible to reduce the written text. At the end of every chapter, selected references are listed. The quality of the figures is very well and they are well chosen to show all typical findings. Summarizing, this book was written from experts for experts, not to present the latest scientific study but to support all colleagues in their daily work. Indeed, the book imparts the basic principles of forensic medical appraisal across all fields of our specialty, whilst at the same time highlighting diagnostic and methodological perspectives. This work will be very helpful to all experts working in the field of Forensic Medicine.

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