CORRESPONDENCE

Boxing—Acute Complications and Late Sequelae: From Concussion to Dementia

by Prof. Dr. med. Hans Förstl, Prof. Dr. rer. nat. Christian Haass, Prof. Dr. med. Bernhard Hemmer, Prof. Dr. med. Bernhard Meyer, Prof. Dr. med. Martin Halle
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Fatal Outcome Cannot Be Ruled Out

The current article is an important contribution to a type of "professional sports" in which the aim is to render the opponent unable to fight by means of inflicting intentional bodily harm (a fatal outcome cannot be ruled out). The International Consensus Statement on Concussion in Sport is worth mentioning in this context (1). It explains all important aspects and lists recommendations for diagnostic evaluation and therapy. Such (cerebral) concussion also occurs in other types of sports, such as football (American football), with similar late sequelae in some athletes, rarely baseball and ice hockey (puck injuries) with acute trauma, such as cardiac concussion. The authors' analysis again throws up the question of whether this type of "sports", which has a high profile in the media, should be allowed from a medical and ethical perspective. The gladiators of ancient Rome spring to mind. We need to ask whether all boxers should be genetically screened for the ApoE4-polymorphism, in order to remove those at particular risk from this "sport".

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When Does Long Term Damage Develop?

With regard to the role of the allelic variant 4 of apolipoprotein E (APOE), it should be added that Jordan et al showed as early as in 1997 in a study in boxers a high risk of encephalopathy in carriers of the APOE 4 feature. Later, it was found in victims of accidents that the prognosis of cerebral damage was relatively unfavorable if they were of the APOE4 genotype (2).

The biological involvement of APOE also includes the lipid transport into the central nervous system and involvement of neural regeneration after injuries. The genotype 4 was unfavorable for repair processes. In carriers of this genotype, the brain's recovery mechanism is therefore deficient and they are therefore particularly at risk of developing boxer's encephalopathy. Other genetic factors have also been mentioned in this setting (3).

What does this mean for clinical practice?

Even today, genetic screening is possible in order to identify persons in boxing who are at particular risk of encephalopathy. Determining the APOE genotype would be sufficient to do so. Neuron specific Enolase (NSE) or S100B follow-up are also possible. Such an approach, however, would entail fundamental ethical questions.

- Should sports clubs be allowed to force their members to undergo genetic/biochemical screening?
- Should athletes with a characteristic genotype (and/or abnormal development of the destruction markers NSE and S100B) be excluded from boxing?
- Is there a right to ignorance specifically with regard to these matters?
- Is there a "right to inflict self harm"?

Basically, the time has come to rethink all these questions with regard to boxing.

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Chronic Damage Has Been Underestimated

The review article „Boxing—Acute Complications and Late Sequelae" provides valuable information on the acute sequelae and the risks to professional boxers as well as amateur boxers. However, the authors seemed to me to underestimate the chronic harms associated with professional boxing. In my doctoral dissertation, "The schizophrenias after craniocerebral trauma",

Bochum 2006, I cited a study reported by Mendez (1995), which found in about half of 224 randomly selected former British professional boxers some kind of cerebral damage; the clinical indicators included in 40% of cases balance impairment, dysarthria, or alcohol misuse. Mid to late stage chronic traumatic encephalopathy (CTE) was seen in 17%. 50–60% of the professional boxers had cerebral or cerebellar atrophy or ventricular enlargement on CCT. Of note is also the significantly higher proportion of boxers (compared with the general population) with cavum septi pellucidi (in 23% vs up to 5.4%). Cordeiro and de Oliveira (2001) confirmed in a literature review the findings reported by Mendez (1995).

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In Reply:

Lindemann rightly points out that we were conservative in our reporting of the serious risks associated with boxing and that other studies have reported higher rates of damage. The manuscript's reviewers instructed us to adopt a conservative stance, and also we had restricted our study to relevant publications from the past 10 years. Since our article was accepted, some newer studies have been published that point out further risks:

- A lowering and delay of the cerebral attention potential (P300) (1)
- Sensory deficits (2)
- Extensive functional brain changes with hypometabolism in the area of the parietal lobe, posterior cingulate gyrus, frontal cortex, and cerebellum (the first three structures are also functionally and neuropathologically affected in Alzheimer's disease (3).
- An increased risk of Parkinson's disease with an increasing number of fights (study in Thai boxers) (4).

Löllgen and Prange mention ethical problems, which arise from knowing about the fundamentally increased risk (intentional brain injury), particular risk factors (APOE 4 and the destruction markers NSE and S100B), and potential protective measures (such as genotyping, head protection, prohibition of fights, etc). Basically, the following questions need to be addressed:

- What is the justification for granting intentional bodily harm an exemption from legal prosecution and for presenting it as a form of exemplary sportsmanship?
- Whether public broadcasters actually fulfill their remit by broadcasting programs that glorify violence
- Whether the costs should be borne by television-fee payers and by the solidarity based community of people with health and care insurance
- Why medical associations in Germany have thus far not taken position vis-à-vis boxing.

The reaction to our article was not unanimously positive. A former professional boxer, for example, pointed out the specific relevance of specific comorbidities in professional boxing that we had not included in our article (alcohol and drug addiction, promiscuity related problems; ZDF.deSport, "Boxen macht Boxern kein Kopfweh [Boxing does not cause boxers a headache]").

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