Acute Compartment Syndrome Signs and Symptoms Described in Medical Textbooks

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Abstract

Objective: To evaluate the accuracy of commonly accessed medical textbooks in their description of the presenting signs/symptoms of acute compartment syndrome (ACS).

Methods: Textbooks in six different specialties were surveyed for information about ACS. Informational content was scored using a 0 to 4 point system.

Results: 67 textbooks (36 primary care, 31 specialty) were reviewed. Of the 36 primary care textbooks evaluated, 29 contained no information on ACS. Three of the remaining 7 primary care books provided inaccurate information (43%). Only 3 of the 31 specialty books scored 0. Four of the remaining 28 specialty books provided inaccurate information (14%). Overall, 23 of the 31 specialty books (74%) provided accurate information (score of 3 or 4), compared to only 2 of the 36 primary care books (6%) (p<0.001).

Conclusions: Some textbooks contain inaccurate information in the diagnosis of acute compartment syndrome, which may delay the diagnosis resulting in irreversible morbidity. In reality, there are only three P’s (pain, paresthesia, paresis) which are important.

Introduction

Acute compartment syndrome occurs whenever increased tissue pressure in an osteofascial compartment compromises blood flow to muscles and nerves within the compartment, resulting in tissue damage. The elevated compartment pressure, due to various origins such as hemorrhages, fractures, crush injuries, muscle edema and limb casts, leads to blockage of venous outflow and subsequent venous infarction. As the pressure within a compartment exceeds the venous outflow pressure, venous outflow ceases. Without venous outflow, net capillary flow ceases leading to ischemia and subsequent infarction. Intracompartamental infarction results in death of neural tissue as well as rhabdomyolysis. Disability resulting from amputation or permanent limb dysfunction, may result if treatment is not initiated in time.

Because of the seriousness of this condition, prompt diagnosis is essential. It is common practice for compartment syndrome to be described by medical reference texts and resource materials as the 5 P’s, sometimes 6 P’s (Pain, Pallor, Pulselessness, Paresthesia, Paresis, Poikilothermia). In actuality, pulselessness and pallor are NOT presenting symptoms. These would be regarded as late findings (actually too late), indicating a poor prognosis. Pulselessness and pallor are acute signs of arterial embolization, rather than what occurs in an acute compartment syndrome (which is a venous outflow obstruction). Pallor is not usually seen initially due to continuous cutaneous perfusion originated from sources proximal to or outside the involved compartment. Pulselessness is an extremely late finding and is rare upon initial presentation. Arterial pulsation will still occur even if no forward flow occurs, making this a deceiving and dangerous phenomenon, because a clinician may fail to consider the possibility of a compartment syndrome just because pulsation is present. In fact, some textbooks have specifically listed “Pulsation Present” instead of “Pulselessness” as one of the P’s to emphasize this point and counter the misinformation that has been published in the past. Poikilothermia, which probably refers to the coolness of an extremity, is similarly a late sign of compartment syndrome.

Therefore, pallor and pulselessness are not considered reliable criteria for the diagnosis of acute compartment syndrome. Excruciating pain with increasing severity in conjunction with numbness/paresthesia and paresis are highly suspicious for an acute compartment syndrome. It is critical to recognize, diagnose, and treat acute compartment syndrome in a timely manner. Therefore it is crucial that medical references accessed by physicians, physicians-in-training, and other medical personnel are accurate in their description of acute compartment syndrome. Promoting the 5 or 6 P’s suggesting that pallor and pulselessness are signs/symptoms of acute compartment syndrome may contribute to a delay in diagnosis and treatment.

The purpose of this study is to evaluate the accuracy of commonly accessed medical textbooks in their description of the presenting signs/symptoms of acute compartment syndrome.

Methods

A review of medical textbooks was conducted at the Hawaii Medical Library using texts from both the reference and shelved section. Reference texts were exhausted first to ensure that all standard books were covered in our study. Each textbook (which had information on compartment syndrome) was reviewed by a team of three reviewers and assigned a score based on consensus.

Texts that provided no information on acute compartment syndrome were scored as a zero. A score of 1 was assigned if the book indicated that pallor or pulselessness are signs/symptoms of acute compartment syndrome. A score of 2 was assigned if only brief information about acute compartment syndrome was supplied, but...
there was no information suggesting that pallor and pulselessness are signs/symptoms of acute compartment syndrome. A score of 3 was assigned if the text provided accurate information on signs and symptoms (i.e., that pallor and pulselessness are only late signs of acute compartment syndrome). A score of 4 was assigned if the text provided the correct information just as in the score of 3, but additionally, the text described a method to measure intracompartmental pressure. The categories can be summarized below:

- 0 = Compartment syndrome not covered.
- 1 = Incorrect information present.
- 2 = Minimal information present, but nothing which is incorrect.
- 3 = Correct information present.
- 4 = Correct information, plus instructions on how to measure the intracompartmental pressure is sufficiently described.

The content reviewed was focused on acute compartment syndrome. We did not consider chronic compartment syndrome, exercise induced compartment syndrome or abdominal compartment syndrome.

**Results**

We evaluated a total of 67 textbooks (see reference list) for the content and accuracy of their descriptions of acute compartment syndrome. This included 36 primary care textbooks (from pediatrics, family practice, and internal medicine) and 31 specialty references (from critical care, emergency medicine, orthopedics, and general surgery). Textbooks that earned a score of 0 were eliminated from the mean calculation.

Textbook scores are stratified by the specialty areas in table 1. Of the 36 primary care textbooks evaluated, 29 scored 0 (contained no information). Three of the remaining 7 primary care books had a score of 1 (50%, all from internal medicine). Only 3 of the 31 specialty books scored 0. Four of the remaining 28 specialty books had a score of 1 (14%) (p=0.05, Chi-square testing comparing the rate for primary care versus subspecialty textbooks).

Overall, 23 of the 31 specialty books (74%) scored well (3 or 4), compared to only 2 of the 36 primary care books (6%) which scored well (3 or 4) (p<0.001).

**Discussion**

The number of textbooks that incorrectly list pallor and pulselessness as signs/symptoms of acute compartment syndrome is smaller than we expected, but such textbooks with incorrect informational content on this topic, still exist. However, if a primary care physician decides to learn about acute compartment syndrome in a primary care textbook, they are not likely to find any information. Specialty textbooks are more likely to have useful information that is correct.

Mnemonics are commonly used in the education process to facilitate learning. However, in this case, the desire to add more P’s (to augment the mnemonic), has resulted in an educational disservice to physicians who have learned the 5 or 6 P’s. It is difficult to undo this, but future book editors and authors should be careful to avoid this pitfall. In reality, there are only three P’s (pain, paresthesia, paralysis) that are important. The other P’s are too late.

**References**


**Pediatrics books**


**Family Practice books**


External Medicine books

Critical Care books

Emergency Medicine books

Orthopedics books

Surgery books