Referred Visceral Pain: What Every Sports Medicine Professional Needs to Know

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In any type of contact sport, the athlete is susceptible to abdominal trauma. Fortunately, abdominal injuries occur relatively infrequently. Nevertheless, when they do occur, immediate identification, treatment, and medical referral is imperative. The alternative to such action could be disastrous. Thus the athletic trainer or therapist’s ability to fully and accurately assess abdominal trauma to the athlete is paramount in avoiding a potential fatality (2).

Abdominal injuries can present misleading symptoms. Specifically, visceral organs are relatively insensitive to pain—even from stimuli such as cutting or burning.

Referred pain may be the only type of pain that is felt when visceral organs are damaged (8). But referred pain can be confusing and may result in the delay of proper medical referral, since a person can feel pain in a part of the body that is well removed from the site of injury (2). It is extremely important to recognize this phenomenon because a number of visceral afflictions cause no other signs except the referred pain (8).

This article explores the subject of referred pain in some depth so that if it does occur, it can be detected and understood. Early detection and understanding will facilitate a proper evaluation and expedite treatment for the athlete.

The mechanisms for referred pain are discussed. Diagrams are included to clarify these mechanisms. In addition, specific examples of referred pain from visceral organs subject to athletic injury are presented. Finally, basic concepts are summarized and implications for the athletic trainer or therapist are stressed.

Key Points

- Abdominal injuries can present misleading symptoms by referring pain to superficial areas of the body well removed from the injury site.
- Referred pain may be the only indication of injury, thus athletic trainers and therapists need to be aware of this phenomenon.
- By understanding the concept of referred pain, athletic trainers and therapists buy precious time for athletes while securing medical care.

Mechanisms for Referred Pain

The various parts of the human body do not all perceive pain in the same way. An important characteristic of pain relative to visceral injury is its tendency to
irradiate and give rise to referred pain (1, 13). Visceral pain is usually referred to a cutaneous surface. For example, pain due to heart damage may be experienced as pain of the left upper arm or pain passing down the arm into the hand (8, 13). Splenic injury may be referred to the left shoulder and arm, which is known as Kehr’s sign (8). Pain from the liver may be referred to the right shoulder (10).

These misdirections of pain sensation appear to be due to the excitation of a common pool of neurons within the spinal cord, brain stem, or cortex acted on by different afferent sources (13).

Mechanisms for referred pain are illustrated in Figure 1, which depicts the general organization for the afferent pathways of visceral pain at one spinal level.

According to Guyton (8), “It is generally believed that visceral pain fibers may synapse in the spinal cord with certain neurons transmitting pain sensation from the skin” (p. 510). Their synapses may actually cross so that stimulation of visceral pain fibers results in the sensation of cutaneous pain (see Figure 2). Furthermore, according to MacBryde, “referred pain may be due in part to reflex muscle spasm, also mediated through intraspinal nerve connections” (p. 183).

The perception of visceral pain can be extended to many other spinal levels. This fact demonstrates the existence of intermediate neurons connecting the posterior horn cells, as well as interuncial cells connecting the higher and lower segments of the cord. This may be the mechanism responsible for the characteristic referral of splenic pain.

A main point to understand is that the neurons that supply the skin in the area where the pain is felt enter the same segment of the spinal cord as do the neurons that actually conduct the pain stimuli from the visceral organ. An appreciation of this merger into a common path is essential to an understanding of the distributions of visceral pain. Concisely stated, Visceral pain will be noted in that somatic area with which it shares a final common path.

Figure 3 illustrates the relationship of the visceral organs and their afferent pathways. Exactly where these visceral afferents enter the spinal cord and mingle with somatic afferents is the key to the principle of referred pain. Figure 4, the dermatomes (3) (i.e., segments of cutaneous sensation with respect to each spinal level), directly complements Figure 3 by identifying the corresponding area of somatic sensation due to the intersecting visceral afferents.

Under some circumstances, only slight trauma to the abdomen may result in hemorrhage. Free blood in contact with the peritoneum results in peritonitis, which in itself is a medical emergency. This too presents referred pain corresponding to the location of the incoming afferent impulses.

Examples of Referred Pain

Figure 3b illustrates the specific pathologies of referred pain from each selected organ. For example, cardiac pain is experienced by subternal discomfort projected to the neck and left jaw, as well as the left shoulder and arm over the distribution of the ulnar nerve. This is because dermatomes T1–T8 are generally involved.

Less frequently, pain may be referred to the right shoulder and arm or to both shoulders, arms, and hands. Occasionally, anginal pain may be projected posteriorly to the area of the left scapula at the interscapular region (10), as in left ventricular involvement.

With respect to the lungs, extreme damage may occur in the absence of pain until inflammation extends to the parietal pleura. The pleural irritation then gives rise to pain along the dermatomes corresponding to the spinal levels of the incoming afferent impulses C8–T8 (10).

The diaphragm is supplied by somatic nerves that enter C3–C5. Any painful stimulus to the parietal peritoneum is referred along the corresponding cutaneous nerves. Thus diaphragmatic pain is characteristically referred to the shoulder area’s cutaneous distribution of C3–C5 (9).

Trauma to the esophagus gives rise to pain on the sternal region of the thorax corresponding to the site of the lesion (i.e., an upper esophageal lesion yields manubrial pain; a lower esophageal lesion yields xiphoid pain or pain in the epigastrium (8). Esophageal afferent fibers enter the lower cervical and all thoracic levels, but especially T5–T6 (8), which corresponds to the above regions of perceived pain.

Splenic afferent impulses course the phrenic nerve at the C3–C5 levels (5), presenting sharp cutaneous pain projecting to the left shoulder and about one third of the way down the arm.

This region does not really correspond to that of the spinal levels of the phrenic nerve. Apparently, as noted earlier, longitudinal intermediate neurons within the spinal cord itself become involved, mediating and projecting the impulses farther