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Posterior Humeral Circumflex Artery Aneurysms in Two Collegiate Pitchers

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Abstract

Posterior humeral circumflex artery aneurysms in upper extremity athletes are a rarely described entity now beginning to gain wider recognition in the medical literature. Recent studies have demonstrated that these aneurysms may be underdiagnosed and that appropriate recognition with early diagnosis is imperative for improved outcomes. This case report aims to increase awareness of posterior humeral circumflex artery aneurysms and to educate physicians on the appropriate recognition of symptoms, diagnosis, and treatment. We describe two presentations of the same injury, as well as an approach to diagnosis and treatment. We also discuss new diagnostic techniques and future research plans.

Level of Evidence: Level III diagnostic study.

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Overhead athletes, such as baseball and volleyball players, place extreme physiologic stress on their anatomy.^{1,2} Although vascular complications are rare, they have been reported in cases of thoracic outlet and Paget-Schroetter syndromes.^{3,5} Arterial injuries to the axillary artery and its branches are less commonly described, specifically the development of aneurysms and subsequent thromboemboli in the posterior humeral circumflex artery (PHCA). A literature review of data published from 1972 to 2015 revealed only 60 athletes with axillary artery and/or branch occlusions or aneurysms.¹⁻¹⁰ Of these 60, approximately 75% were baseball pitchers, with the remaining 25% participating in volleyball, windsurfing, handball, kayaking, tennis, and softball. We present the cases of two

collegiate baseball pitchers who developed PHCA aneurysms to increase awareness of this relatively uncommon injury in light of new diagnostic protocols and increased prevalence.

Patient 1

A 19-year-old left-handed pitcher initially presented with complaints of vague left arm discomfort and throbbing pain at night that had been present for more than a month. There was no history of trauma or other possible cause that he could identify. Initial physical examination demonstrated full range of motion, and the patient was noted to be neurovascularly intact. He was administered diclofenac and given specific shoulder exercises for presumed thoracic outlet syndrome.

Figure 1



Angiogram of the left upper extremity demonstrating a pseudoaneurysm of the posterior humeral circumflex artery (arrow).

At his 3-week follow-up, he described worsening pain following practice and had a positive Spurling test. The ankle-brachial index test and an MRI of the cervical spine were both negative, and the patient was given activity modification instructions. At

Figure 2



Excised aneurysm from portion of the left posterior humeral circumflex artery.

his next 6-week follow-up appointment, he noted continued pain in the left arm while throwing and described “aching” in the arm that occurred intermittently. He also noted a 36-hour history of a “cooler left hand.” On examination, he was found to have decreased sensation with use of the left arm and hand, less prominent distal radius pulses, increased capillary refill delay, and filling with an Allen test of 8 to 9 seconds (left hand) versus <4 seconds (right hand).

Magnetic resonance angiography (MRA) demonstrated an extensive arterial thrombus of the radial and proximal ulnar arteries. The patient was admitted to the hospital. An angiogram of the left upper extremity demonstrated evidence of chronic embolic disease with near-complete occlusion of the radial artery and a long segment proximal occlusion of the

ulnar artery with reconstitution distally. A pseudoaneurysm of the posterior humeral circumflex humeral artery 1.5 cm from its origin was also identified (Figure 1).

Positional origin occlusion of the artery when the patient assumed the abducted, externally rotated position was thought to contribute to the etiology of the aneurysm as well as contributing to the embolic phenomena. Four hours of intra-arterial thrombolysis was attempted with no significant improvement to the radial or ulnar artery thrombi. The patient ultimately underwent surgery to ligate and excise the aneurysm, as well as an ulnar artery bypass using the saphenous vein graft (Figure 2).

Patient 2

A 20-year-old left-handed pitcher presented with 1-week complaint of left arm discomfort and fatigue while working with a throwing specialist over winter break. He also described pale fingers following throwing activity. His symptoms had worsened significantly over 7 days. On examination, his left hand was noted to be cooler than the right, with a delayed Allen test of 7 to 8 seconds. An MRA of the left upper extremity demonstrated abrupt termination of the ulnar artery at the wrist just distal to the hamate, with the radial artery serving as the sole supply to the deep and superficial palmar branches. There were also deficiencies in two radial and ulnar digital arteries. Finally, there was abrupt termination of the posterior branch of the common interosseous artery.

The patient was referred to vascular surgery for consultation and to

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undergo CT angiography (CTA) of the subclavian and visible axillary arteries. This demonstrated a 6-mm aneurysm of the left PHCA. Vascular surgery was undertaken to ligate the left PHCA and repair the left axillary artery, using a flap of the ligated branch.

Follow-up

Postoperatively, patient 1 experienced a median mononeuropathy with weakness in the left index finger. This was related to extended retraction during vascular surgery and not to the vascular injury itself. After 9 months of therapy to regain increased range of motion and strength, the patient had regained nearly full strength and was cleared to full activity, including pitching from the mound. Ultimately, he chose to stop playing baseball and did not rejoin the team the following year.

Patient 2 returned to practice at 4 weeks postoperatively. He began a throwing program with progressive speed and distance increases before being allowed to start throwing from the mound at 6 weeks postoperatively. The patient experienced unrelated shoulder and back pain but had returned to full activity at his 20-week postoperative evaluation. He returned to competitive play that season, making four appearances and ultimately rejoining the team the following season without restriction.

Discussion

Overhead athletes place extreme forces on their bodies, risking damage to both osseous and soft-tissue structures. Although muscular and ligamentous injuries have been well described in the upper extremities, vascular injuries are a relatively rare pathology that only recently has begun to garner increased attention.

The arm position in pitching has been shown to generate increased tension

and compression forces across the vasculature, with abduction, external rotation, and extension seen in the late cocking phase previously reported to cause intimal damage. Rohrer et al⁹ reviewed 92 extremities in the throwing position and found compression of the axillary artery in 82%. Another study by Stapleton et al¹⁰ found >50% reduction in axillary artery diameter with the arm held in the throwing position. The intimal damage from this compression is thought to be the cause of developing aneurysms in overhead athletes. These studies demonstrated the potential for injury to the axillary artery and its branches, but there have been few reports in the literature about the actual incidence of these injuries. Recent studies demonstrate that this may be more of a widespread, occult issue in high-level athletes. van de Pol et al⁸ looked at a large cohort of 280 volleyball players in the Netherlands and found the incidence of PHCA aneurysms to be 4.6%. Previous reports of cases in baseball players show a low incidence in relation to the number of players, but the study by van de Pol et al⁸ demonstrates that this may be vastly underdiagnosed and exemplifies the need for increased awareness and better screening of overhead athletes for this type of injury.

The varied presentation of this condition highlights the need for physicians to maintain a high level of suspicion when considering vascular pathology in the overhead athlete. Athletes may present with nonspecific symptoms that mimic other injuries and conditions, including thoracic outlet syndrome, Raynaud syndrome, and hypothenar hammer syndrome, along with general muscle strains. Workup of the differential diagnosis may still miss PHCA aneurysms without specific imaging protocols in place for detection. These symptoms may be seen over a longer period, as with patient 1, or may present more acutely, as seen with Patient 2.

Regardless of timing, an awareness of the stress on the upper extremities is necessary for clinicians to appropriately diagnose PHCA aneurysms in a timely manner. The risk of missed or delayed diagnosis of aneurysms in athletes includes embolization, pain, digital ischemia, amputation, and a threat to future athletic endeavors. Our two patients, after weeks of symptoms, were experiencing vascular insufficiency that could have proved to be limb threatening had detection not been as expedient as it was. No specific timeline for diagnosis exists, but it stands to reason that early detection of these vascular injuries has the benefit of improving health, function, and continued ability to participate in sports.

To date, diagnosis has relied on expensive imaging involving radiation and contrast exposure to the patients. Both MRA and CTA were used to make the final diagnosis in these two pitchers. van de Pol et al⁷ recently developed the SPI-US study, a protocol for quickly, accurately, and cost effectively evaluating the PHCA with ultrasonography in a 5- to 10-minute examination. Their work has been shown to be both reliable and reproducible, and although both athletes in this report had diagnoses made after MRA and/or CTA, it is logical that an appropriate ultrasonography protocol could have resulted in a similar diagnosis. We now hope to continue this work by implementing this study in the evaluation of Division I volleyball and baseball athletes. The goal is to further assess the prevalence of PHCA aneurysms in collegiate athletes and to show the effectiveness of ultrasonography both for diagnosis and possible screening in high-risk athletes. Future research may investigate whether a certain age group, sex, or sport should be screened or whether evaluation should be reserved for symptomatic patients.

Finally, rehabilitation guidelines and recurrence of vascular damage

are not well understood at this time. We followed vascular surgery recommendations for return to play, with return to practice at 4 weeks postoperatively. It is recommended that players follow a progression from light throwing to full pitching, but at this time, there is no standardized rehabilitation protocol. As more athletes are potentially diagnosed and treated for this issue, the authors hope to better understand the rehabilitation process and the potential for recurrence.

Conclusion

Vascular injuries in overhead athletes remain a rare but potentially devastating injury. Early detection provides athletes with the best chance for treatment, recovery, and return to activity. A high level of suspicion and appropriate diagnostic studies can

aid in a fast and reliable diagnosis, allowing for early treatment and improved outcomes. Further research into prevalence and screening criteria will aid in future management of PHCA aneurysms.

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