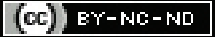


A Longitudinal Study on the Rare Entity of Acromial Apophysitis in Paediatric and Adolescent Ages

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ABSTRACT

Introduction: Acromial apophysitis is a traction apophysitis caused by repetitive stress to the distal acromion. Although it is a common non-traumatic cause of shoulder pain in adolescence, data is scarce in the literature. There is a need for a better understanding of acromial apophysitis regarding its cause, diagnosis and management.

Aim: To determine the cause, clinical features, radiological findings, management, and outcome of the patients diagnosed with acromial apophysitis.

Materials and Methods: A longitudinal descriptive study was carried out at Jaipur National University Institute for Medical Sciences and Research Centre (JNUIMSRC), Jaipur, Rajasthan, India, from August 2018 to August 2022. A total of 30 patients aged 10-20 years with shoulder pain, diagnosed with acromial apophysitis based on history, clinical, and radiological examination, were included in the study. The treatment given, duration of disease, and outcome were noted. Descriptive statistics were performed using Microsoft Office Excel.

Results: Out of 30 patients diagnosed with acromial apophysitis, 24 (80%) were male, and 6 (20%) were female, with a mean age of 13.47 (range 10-18) years. The cause was repetitive micro-trauma following chronic overuse during athletic and sports

activities in 24 patients (80%). Among these patients, 13 played cricket, three played basketball, three played volleyball, two did weightlifting, one was a wrestler, one was a tennis player, and one was a judo player. Six patients (20%) did not give a history of playing any kind of sports. All patients had anterior shoulder pain with tenderness at the antero-lateral acromion. Radiographs showed fragmentation, sclerosis, and irregularity of the acromial apophysis. Conservative treatment included rest and restriction of sporting activities. The duration for the analgesics taken by patients was 8.9 days (range 3-21). The duration from the onset of symptoms to recovery was 5.8±1.61 weeks. None of the patients showed a recurrence of symptoms after complete recovery.

Conclusion: Acromial apophysitis is a common cause of shoulder pain in paediatric and adolescent age. It occurs due to repeated overhead abduction, overuse, and throwing activities, mostly in sports persons. It is diagnosed clinically and confirmed with plain radiographs. It is a self-limiting disease with a short benign course. It is treated conservatively with rest and analgesics and has an excellent outcome. This diagnosis should be kept in mind for shoulder pain in young patients to prevent undue investigations and surgery.

Keywords: Acromion, Apophysis, Clinical, Radiological, Shoulder pain

INTRODUCTION

Apophysis is an accessory ossification center that overlies the growth plate and is subjected to traction forces of the muscles and tendons attached to them [1]. Acromial apophysitis is a disorder caused by repetitive stress to the distal acromion in paediatric and adolescent age. It arises due to traction forces exerted through the tendons and muscles which insert into or arise from the acromion [2]. These are common in skeletally immature individuals involved in sports with overhead activities [3,4]. The vigorous contraction of the deltoid muscle during throwing activities can cause micro-fractures, irritation, and inflammation at the weak area of the apophysis [5,6]. Only a few cases of acromial apophysitis have been reported previously [5-8]. All these described cases have similar symptoms, signs, and radiographic findings. This entity with similar clinical findings is described as acromial apophysiolysis in few studies [9,10]. Pitching was identified as a risk factor for superior shoulder pain in young throwing athletes [9].

The clinical manifestation of acromial apophysitis is typically characterised by shoulder pain in physically active skeletally immature patients. The pain is localised by palpation at the antero-lateral region of the acromion [6]. Diagnosis is based on history, clinical examination, and radiological findings [7]. Plain radiographs show fragmentation, irregularity, and sclerosis of the acromial apophysis [5-7]. Acromial apophysitis has a benign course, and treatment is conservative.

Resting, applying ice, stretching, strengthening the shoulder muscles, using an arm pouch, and taking anti-inflammatory drugs largely solve the problem [11]. Although the disease usually has a benign course, it sometimes require extended treatment or causes an active athlete to stay away from the field for a while [6].

Apophysitis does not disrupt skeletal growth and has a favourable recovery or prognosis [6]. But it is necessary to diagnose and treat acromial apophysitis as it is associated with os acromiale and rotator cuff tears after 25 years of age [9]. Increased knowledge of acromial apophysitis and its risk factors can help physicians diagnose the disease as early as possible. Early diagnosis also helps to reduce the need for further higher radiological evaluations and un-necessary surgical interventions, which can be harmful and costly to the patients. This study intends to fill existing gaps in the literature, identify individuals at risk, and provide valuable insights into the diagnosis and treatment of acromial apophysitis.

Therefore, the study aimed to determine the aetiology, risk factors, clinical features, and radiological findings of acromial apophysitis and also to evaluate the management, outcome, and consequences of acromial apophysitis.

MATERIALS AND METHODS

This longitudinal descriptive study was conducted in the Department of Orthopaedics at Jaipur National University Institute for Medical

Sciences and Research Centre (JNUIMSRC), Jaipur, Rajasthan, India, from August 2018 to August 2022. The Institutional Ethics Committee approved the study (JNUIMSRC/IEC/2018/27).

Inclusion criteria: Patients diagnosed with acromial apophysitis based on history (shoulder pain), clinical examination, and radiological findings were included in the study.

Exclusion criteria: All trauma cases, concurrent labral or rotator cuff abnormalities, distal clavicular osteolysis, little league shoulder (proximal humeral epiphysiolysis) were excluded. Patients with missing or incomplete data and patients whose diagnosis of acromial apophysitis seemed suspicious, as well as patients who were lost to follow-up, were also excluded.

The records of all 220 patients who came to the outpatient clinic with shoulder pain aged between 10 and 20 years at the time of the first visit were obtained from the database records of the outdoor clinic. Out of 220 patients, 30 patients who met the inclusion and exclusion criteria were included for the final evaluation. These 30 patients were contacted telephonically and called for the final evaluation after a minimum duration of six months.

Study Procedure

In all patients, a detailed history was taken, and a physical examination was conducted. Informed consent was obtained from all the patients regarding the disclosure of data. The patients' age at onset, gender, affected side, anthropometric measurements such as height, weight and Body Mass Index (BMI), duration of symptoms, detailed history, and type of sports involved were recorded. The severity of pain was categorised as mild, moderate, or severe based on the Visual Analogue Scale (VAS), and the point of tenderness at the shoulder was noted. The radiographic findings and treatment duration of the disease were analysed. Radiographs were taken at the time of presentation and when the patient was called for final evaluation after a minimum duration of six months of the disease. The treatment duration was defined as the period between symptom onset and the return to pain-free shoulder range of motion.

STATISTICAL ANALYSIS

Statistical analysis was performed using Microsoft office excel software. Descriptive statistics were presented in percentages and mean±SD for categorical and continuous data, respectively.

RESULTS

Out of 30 patients diagnosed with acromial apophysitis, 24 (80%) were male, and 6 (20%) were female. The mean age of the patient group was 13.47 years (10-18 years). The average age was 13.54 years (10-18 years) for boys and 12.83 years (11-14 years) for girls at the time of the first visit to the clinic. The average height was 160.1 cm±11.58 cm. The average weight was 54.27 kg±8.10 kg, and the Body Mass Index (BMI) was 21.15±1.97. The right shoulder was involved in 21 cases, and the left in nine. None of the cases had bilateral symptoms. The mean duration from the onset of symptoms to recovery was 5.8 weeks±1.61 weeks. The mean Visual Analog Scale (VAS) score at the time of the initial presentation was 5.93±2.26 (range: 2-9). Pain was mild in 6 cases, moderate in 14 cases, and severe in 10 cases according to the VAS Score. Pain and tenderness were localised to the antero-lateral part of the acromion in all cases. Radiographs at the time of diagnosis showed fragmentation, sclerosis, and irregularity of the acromion [Table/Fig-1]. None of the cases had any residual pain at the final follow-up. All of them showed healing of the acromial lesion in radiographs taken at the final follow-up [Table/Fig-2].

Out of 30 patients, 24 (80%) were involved in sports and athletic activities. Among these patients, 13 played cricket, three played basketball, three played volleyball, two did weight lifting, one was a wrestler, one was a tennis player, and one practiced judo. Initially, oral



[Table/Fig-1]: X-ray of the right shoulder showing irregularity, sclerosis and fragmentation of the acromion.



[Table/Fig-2]: X-ray at follow-up at six months showing healing of the acromion apophysitis.

Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) were initiated in all patients. The daily dose was divided into two and given every 12 hours. The duration for which the analgesics were taken by the patient was 8.9 days (3-21 days). Patients were advised to avoid sports activities and daily activities involving overhead abduction. Ten patients with severe pain were advised for arm immobilisation for 1 to 4 weeks, depending on the severity of pain. Range of motion exercises were started when the patient was pain-free and asymptomatic. None of the patients showed a recurrence of symptoms after recovery during a minimum follow-up of six months.

DISCUSSION

Acromial apophysitis is a condition seen in young athletes involved in overhead sports activities. This disease is characterised by pain and inflammation involving the acromion. While acromial apophysitis has been a common cause of shoulder pain in young athletes, there is still limited research on this condition and its optimal management [Table/Fig-3] [5-7,9,12]. In this study, 30 cases of acromial apophysitis with a minimum follow-up of six months were included. All the patients were in the age group of 10-20 years, with 80% of patients involved in athletic or sports activities. The chief complaint was shoulder pain, and all the patients responded well to conservative management with the restriction of activities.

Overuse injury to the shoulder with repetitive stress at the acromion has been reported as the causative factor of acromial apophysitis

Authors	Cases (No.)	Age/Sex (Years, M=male/ F=female)	Sport activities	Side	Presentation	Imaging	Treatment
Morisawa K et al., [6]	3	12 (M), 14 (M), 13 (F)	Athletes Judo, Baseball, Basketball	12 M=Left 14 M=Right 13 F=Left	Pain on sports activities	X-rays: Fragmentation and sclerosis Bone scan: increased uptake	Conservative
Moyes DA et al., [5]	1	14 (F)	Heavy school bag, No sports activities	Right	Pain on the acromion	Irregularity of right apophysis Bone scan: increased uptake	Rest and anti-inflammatory drugs
Quinlan E and Bogar WC et al., [7]	1	13 (F)	Basketball, football, soccer, and track and field	Left	Shoulder pain with lifting heavy weight	X-rays: irregularity, fragmentation and sclerosis	Interferential therapy, soft tissue manipulation and exercises.
Roedl JB et al., [9]	61	19.5 (41M) 19.7 (20F)	Male=baseball Female=Softball	Dominant arm in pitching	Superior shoulder pain with pitching of baseball or soft ball	Oedema and incomplete fusion across acromial apophyses on MR images	NSAIDS, with cessation of pitching for 3 months.
Dharmshaktu GS [12]	1	14 (M)	Cricket	Left	Throwing and bowling	Increased distance between acromion apophysis and acromion body with irregular surfaces of apophysis	Rest, fomentation and taping
Present study	30	13.54 (24M) 12.83 (6F)	Cricket=13, Basketball=3 Volleyball=3, Weightlifting=2, Wrestler=1, Tennis=1 Judo=1, None=6	Right=21 Left=9	Pain at the top of shoulder (Anterolateral part of Acromion)	X-rays: fragmentation, sclerosis and irregularity	Conservative with restriction of sports activities and overhead abduction, shoulder immobiliser for 1 to 4 weeks in 10 cases

[Table/Fig-3]: Summary of previous studies/case reports of acromial apophysitis [5-7,9,12].

[3,4]. In the present study, 24 cases were involved in sports activities with overhead abduction. The various sporting activities included cricket, basketball, volleyball, wrestling, judo, tennis, and weight lifting. Thirteen cases were involved in cricket, and out of them, 10 were fast bowlers. Morisawa K et al., reported three cases in young athletes involved in overhead sports activities, and all had a satisfactory outcome with conservative management [6]. Dharmshaktu GS reported acromial apophysitis in a 14-year-old fast cricket bowler [12]. In cricket, players often experience overhead throwing motions which lead to stress at the acromial apophysis. Erin Quinlan E and Bogar WC reported the overuse of the shoulder causing traction apophysis of the acromion in a 13-year-old adolescent boy playing basketball, football, soccer, and track and field [7]. Roedl JB et al., identified baseball or softball pitching as a risk factor for acromial apophysitis [9].

Six cases in the present study had no history of playing any kind of sports. The daily routine overhead activities along with the use of heavy school bags in the six patients with no sports activity might be the cause of acromial apophysitis in the paediatric and adolescent age group. Moyes DA et al., proposed that the contraction of the deltoid muscle against the pressure of a heavy school bag caused tension at the insertion point on the acromion, resulting in acromial apophysitis [5].

The mean age of the study group was 13.47 years (range: 10-18 years). The average age was almost the same for girls and boys. Similar age groups have been reported in previous case reports. Twenty-seven cases were under 15 years of age, and three cases were over 15 years of age (two were 17 years old, one was 18 years old). Roedl JB et al., found in their study that the average age was 19.6±2.80 years (range: 15.0-24.7) and described this entity as acromial apophysiolysis [9].

In this study, plain radiographs were used for diagnosis and to evaluate healing during follow-up. Plain radiographs showed sclerosis, fragmentation, and irregularity of the acromial apophysis. Similar radiological findings have been reported in various case reports [5-7]. Some studies have used Magnetic Resonance Imaging (MRI) or bone scintigraphy for the diagnosis of acromial apophysitis and to rule out other pathologies such as os acromiale, subacromial impingement, or rotator cuff tears [9,13]. Given the self-resolving course of acromial apophysitis with a good prognosis, costly investigations can be avoided. More advanced investigations like MRI can be considered in older age groups with longer symptom duration or when the diagnosis is uncertain.

In this study, all cases responded well to conservative management with analgesics and anti-inflammatory drugs, along with restrictions on sporting activities for 1 to 4 weeks depending on the severity of pain. Ten patients with severe pain were advised for arm immobilisation. In the study by Roedl JB et al., all cases were managed conservatively with anti-inflammatory drugs and a three-month cessation of pitching [9]. Other case reports have also shown symptom resolution within one to six months with conservative treatment [5,6].

Acromial apophysiolysis is significantly associated with the development of an os acromiale and rotator cuff tears after the age of 25 [9,13]. Therefore, it is crucial to diagnose acromial apophysitis/apophysiolysis early, restrict overhead shoulder use for a brief period, and prevent complications such as os acromiale, sub-acromiale impingement, and rotator cuff tears. Acromial apophysis disorders in the adolescent and paediatric age group differ from acromial disorders in older age groups in terms of diagnosis, treatment, prognosis, and consequences.

Limitation(s)

The main limitations were a small sample size and a short follow-up period. Furthermore, higher investigations such as MRI and bone scans were not conducted. It is recommended that a study with a larger sample size, a longer follow-up period, and a similar course of management be undertaken to examine the recurrence of the disease or any relationship with rotator cuff tears or os acromiale in the coming years of life.

CONCLUSION(S)

Traction apophysitis of the acromion, also known as acromial apophysitis, develops in paediatric and adolescent individuals engaged in overhead sporting activities. Conservative management, such as restricting overhead sports activities, immobilising the shoulder, and prescribing anti-inflammatory drugs for a brief period, yields satisfactory outcomes. Clinicians should maintain a high index of suspicion for diagnosing it in the paediatric and adolescent age groups, especially in countries like India where cricket is the most commonly played sport.

REFERENCES

- [1] Kaeding CC, Whitehead R. Musculoskeletal injuries in adolescents. *Prim Care*. 1998;25(1):211-23. Doi: 10.1016/s0095-4543(05)70333-x. PMID: 9469924.
- [2] Rask MR, Steinberg LH. Fracture of the acromion caused by muscle forces. A case report. *J Bone Joint Surg Am*. 1978;60(8):1146-47. PMID: 721873.

- [3] Taneja AK, Negromonte FP, Skaf A. Stress injury of the acromion: Case report and literature review. *Eur J Orthop Surg Traumatol.* 2013;23(Suppl 2):S189-92. Doi: 10.1007/s00590-013-1181-6. Epub 2013 Feb 13. PMID: 23412322.
- [4] Ward WG, Bergfeld JA, Carson WG Jr. Stress fracture of the base of the acromial process. *Am J Sports Med.* 1994;22(1):146-47. Doi: 10.1177/036354659402200123. PMID: 8129099.
- [5] Moyes DA, Mawhinney D, Finch MB. Acromial apophysitis. *Rheumatology (Oxford).* 2000;39(10):1164-65. Doi: 10.1093/rheumatology/39.10.1164. PMID: 11035147.
- [6] Morisawa K, Umemura A, Kitamura T, Ide J, Yamaga M, Takagi K. Apophysitis of the acromion. *J Shoulder Elbow Surg.* 1996;5(2 Pt 1):153-56. Doi: 10.1016/s1058-2746(96)80012-7. PMID: 8742881.
- [7] Quinlan E, Bogar WC. Acromial apophysitis in a 13-year-old adolescent boy: A common condition in an uncommon location. *J Chiropr Med.* 2012;11(2):104-08. Doi: 10.1016/j.jcm.2011.10.008. PMID: 23204953; PMCID: PMC3368973.
- [8] Spehler H. L'apophyse acromiale: Une nécrose aseptique de l'os de localisation rare [Acromial apophysitis: An aseptic necrosis of bone in a rare location]. *J Radiol Electrol Med Nucl.* 1965;46(11):751-52. French. PMID: 5851421.
- [9] Roedl JB, Morrison WB, Ciccotti MG, Zoga AC. Acromial apophysiolysis: Superior shoulder pain and acromial nonfusion in the young throwing athlete. *Radiology.* 2015;274(1):201-09. Doi: 10.1148/radiol.14140587. Epub 2014 Oct 14. PMID: 25314006.
- [10] Kjellin I. Acromial apophysiolysis. *MRI Web Clinic. Radsources;* 2015. Available from: <https://radsources.us/acromial-apophysiolysis/>. Accessed June 20, 2021.
- [11] Doral MN, Aydog ST, Tetik O, Atay OA, Turhan E, Demirel HA. Multiple osteochondroses and avulsion fracture of anterior superior iliac spine in a soccer player. *Br J Sports Med.* 2005;39(3):e16. Doi: 10.1136/bjism.2004.013979. PMID: 15728684; PMCID: PMC1725144.
- [12] Dharmshaktu GS. Acromian Apophysitis An important cause of shoulder pain in adolescent bowler. *Int J Res Orthop.* 2019;29(1):01-02.
- [13] Pagnani MJ, Mathis CE, Solman CG. Painful os acromiale (or unfused acromial apophysis) in athletes. *J Shoulder Elbow Surg.* 2006;15(4):432-35. Doi: 10.1016/j.jse.2005.09.019. PMID: 16831646.

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