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Abstract

Accessory navicular bone is a normal variant which can cause symptoms. Various operative and non operative treatments are used to improve symptoms. There is lack of good quality published literature on either non-operative or operative management. It is generally agreed that non-operative management in the form of symptomatic control, orthoses and physiotherapy is the first line of treatment method. Surgical options include excision of the accessory navicular bone, excision with posterior tibialis tendon reconstruction, arthrodesis of the accessory to the anatomical navicular and percutaneous drilling. Flat foot deformity should be assessed because of its potential role in the development of symptoms and need to be managed together with the accessory navicular bone.

Keywords

Accessory navicular • Accessory tarsal navicular • Prehallux • Accessory scaphoid • Os tibiale externum • Os naviculare secundarium • Navicular secundum • Adolescent

Background

Accessory navicular bone is a normal anatomic variant usually located medial and plantar in relation to the anatomical navicular bone. The navicular bone is the last tarsal bone to ossify, occurring between the age 1–3 year in girls and 3–5 year in boys. The accessory navicular bone ossifies even later. A proportion persists through adult life [1].

In the modern English literature, accessory navicular bone is further divided into three types according to location and relationship with the navicular bone. Type 1 is a small round ossicle within the substance of the posterior tibialis tendon, Type 2 is larger triangular shaped and connected to the navicular by a cartilaginous or fibrocartilaginous synchondrosis whereas Type 3 is a cornuate shaped navicular

following the fusion between the accessory and the anatomical navicular bones (Fig. 47.1).

The incidence and frequency of types varies according to geographical and age group population studies. Corkun et al. found 11 % of 650 Turkish adult displayed radiographic appearance of accessory navicular bone with similar distribution within the three types (33 %, 31 % and 46 % respectively) [2].

In a study of 148 patients younger than 18 year old with accessory navicular bone in Korea, there were more patients exhibiting Type 2 variant (76 % vs 15 % Type 1, 9 % Type 3) and 87 % of patients had bilateral accessory navicular bone [3].

Why Does It Become a Problem?

There are arguments for a traumatic origin with repetitive chronic stress. Histological examination showed areas of microfracture with acute and chronic inflammation and tissue cellular proliferation around the synchondrosis [4]. In this case, the accessory navicular bone is acting as an irritant. On the other hand, there are also proponents of an inbuilt anatomical anomaly or abnormal posterior tibialis

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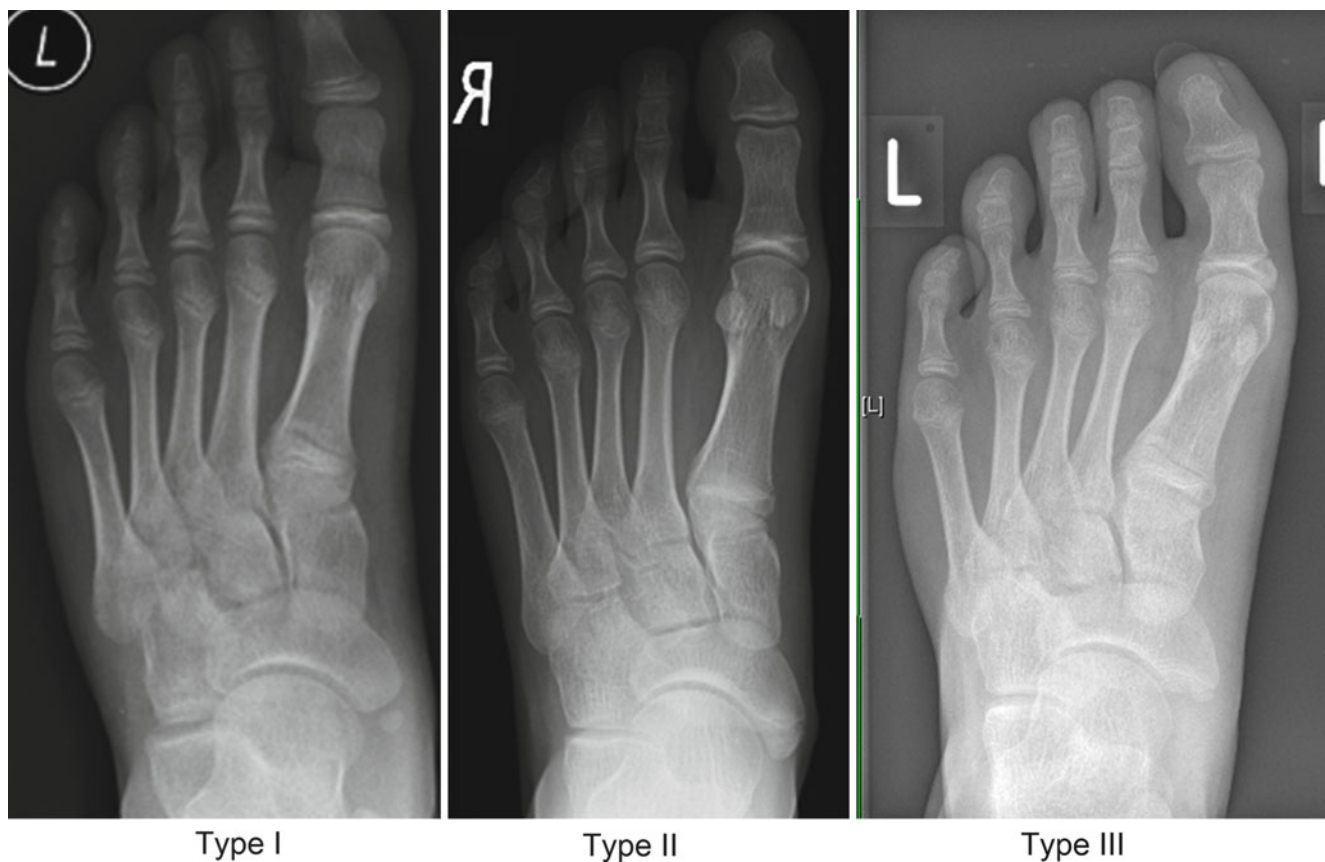


Fig. 47.1 Types of accessory navicular bone

tendon insertion with abnormal tissue between the accessory and navicular bones [5].

Accessory navicular bone can become symptomatic with or without trauma [6, 7]. Pain is usually over the enlarged area of accessory navicular on the medial aspect of foot just at the insertion of posterior tibialis tendon. Tight shoes, walking and exercise exacerbate pain. There is increased pain with resisted inversion of the foot.

External oblique (medial to lateral) plain radiograph complements the dorsoplantar view in diagnosing the accessory navicular bone. Magnetic resonance imaging is sensitive in showing marrow oedema in symptomatic adolescents. The marrow oedema also diminishes following the relief of symptoms after non-operative management [8]. Technetium bone scan is sensitive in showing increased tracer uptake but not specific because half of asymptomatic patients demonstrate the similar features of symptomatic patients [9].

How to Treat Symptomatic Accessory Navicular Bone

Non-operative Management

Non-operative management including symptomatic management in the form of soft pads between the foot and sole of

shoe, footwear modification, physiotherapy, orthoses to off-load midfoot and oral anti-inflammatory can be effective even for active adolescent [10–12]. Non-operative treatments are usually individualised according to patient and provider factors and there is no known literature on the most effective or widely agreed non-operative protocol or comparison against operative treatment. Most authors tried at least three months of non-operative management before proceeding with surgery [6, 7, 12–17].

Injection

We could not find published English literature using digital search engines on the topic of efficacy of injection in the management of symptomatic accessory navicular bone.

Surgery

Surgery aims to improve pain by removing the accessory bone or stabilising the synchondrosis and protecting the posterior tibialis tendon. Most common accessory navicular bone requiring surgery was Type 2. Table 47.1 summarises the references discussed below.

Excision

Bennett et al. recommended excision surgery with repair of the posterior tibialis tendon without advancement due to its simplicity and low rate of complication [18] (Fig. 47.2).

Table 47.1 Surgical treatment of symptomatic accessory navicular bone

Studies	Study type	No. of patients	Age (Y)	Accessory navicular type	Onset to surgery (month)	Preop mx duration (month)	Surgery	Follow up	Outcomes	Notes
Bennett 1990	n/a	50 (38F:12M) 75 ft (56F:19M)	12.6 (8–18)	2 (77%) 3	n/a	>6	Excision of accessory bone or prominent cornuate navicular + postop cast 2 w in equinovarus	2–22 y	77% 'excellent' 16% 'good' 4% 'fair' 3% 'poor' All females able to wear high heels	20 FFF 8% residual prominence, 1% neuroma, 5% superficial inflammation, 7% scar problems
Kiter 2000	n/a	17 (13F: 4M)	14–36	2	Chronic	n/a	Excision and rasping of remaining bone + postop cast 2 w	3 y (2–5 y)	11 patient no pain, no restriction of activity, no shoe wear modification	Inability to single-heel raise persist postop in flatfoot
Jasiewicz 2008	n/a	22 (17F: 5M) 34 ft	14 (9–22)	1, 2 (50%), 3	n/a	3	Excision +/- PTT reattachment + supinating insoles 4 w	5.6 y (1–13 y) 1 lost to f/u	Improved VAS in all except 1 pt. unchanged in pain and shoe wear	Single heel rise test positive pre and post in all cases 2 prolonged wound healing
Prichasuk 1999	n/a	28 (20F: 8M) 31 ft	23 (11–38)	2	n/a	>6	Kidner + cast 6 w + insoles 6 m	3.2 y (1–14 y)	27 pts 'good' results	3/25 FFF improved arch
Lee 2012	Retrospective	41 (8F: 33M) 50 ft	20 (8–48)	2	n/a	6, (7 athletes straight to surgery)	Modified Kidner + cast 6 w	5 y	Improved AOFAS midfoot	
Macnicol 1984	Retrospective	47 62 ft	10–50	n/a	33 (3 m–19 y)	n/a	Kidner (bilateral), n = 26 + postop cast 6 w, vs. excision, n = 21 Both groups have FFF	Kidner 10 y (3–19 y) Excision 12 y (3–20 y)	Kidner – 19/22 FFF pain relieved, 14 shape improve Excision – in those aged 11–12, 15 with normal feet with normal feet pain free, 4/5 in FFF painfree	4 recurrent AN in cases without trimming of navicular tuberosity with 1 persistent pain Kidner patient also report protracted medial pain postop
Cha 2013	Prospective, non randomised	50 (29F:21M) 50 ft	9–15	Unilateral Type 2 +FFF	9.3–10.4	>6	Excision, n = 25 + supinating insoles vs. Kidner, n = 25 + casting	36–52 m	Improved AOFAS midfoot scale and VAS, both groups not statistically different	Similar restoration of medial longitudinal arch in two groups

(continued)

Table 47.1 (continued)

Studies	Study type	No. of patients	Age (Y)	Accessory navicular type	Onset to surgery (month)	Preop mx duration (month)	Surgery	Follow up	Outcomes	Notes
Pretell-mazzini 2014	Retrospective	27 (22F: 5M) 32 ft	13.2 (9–16)	1, 2 (75 %), 3	10 (2–36)	n/a	Excision, n = 14 vs. Kidner, n = 18 (both postop cast 4–6 w) Similar distribution FF both groups	n/a	87.5 % (93 % excision, 83 % Kidner) Good-to-excellent function (no significant difference between 2 groups)	1 tendon Achilles lengthening and lateral column lengthening More complications (painful scar, tendinitis) and reoperation after tendon advancement, but not statistically significant
Scott 2009	Prospective, non- randomised	20 (9F: 11M)	25 (10– 52)	2	n/a	n/a	Fusion screw, n = 10 vs. modified Kidner, n = 10	35 m (21–71 m) vs. 48 m (24–68 m)	Improved final AOFAS midfoot but no significant difference between groups	Corrective surgery performed for significant FF Fusion – 1 removal of screw Worse outcomes in progressive FF
Nakayama 2005	n/a	29 (14F: 15M) 31 ft	10–18	2	4–30	n/a	Percutaneous drillings + postop cast 3 w	32 m (24–37 m)	79 % (23 patient) returned to sports within 3 m, none worse. 18 (feet) union, 13 non-union (all union returned to sports within 3 m)	1 patient with further surgery for severe planovalgus
Garras 2012	Retrospective	20 (14F: 6M) 23 flatfeet	10–27	2	n/a	>6	Subtalar arthroereisis + modified Kidner + cast 6 w	54 m (24–92 m)	Improved AOFAS hindfoot score and VAS	3 removal of implant for impingement
Kim 2014	n/a	13 patients (4F: 9M) 21 ft	10–16	2	n/a	n/a	Calcaneo-cuboid- cuneiform osteotomy + modified Kidner (+ TA lengthening in 4 cases) + postop cast 6 w	12–36 m	ACFAS score from 26.1 to 44.8, improvement in 3 components; pain, appearance, function	

FF flatfeet, FFF flexible flatfeet, PTT posterior tibialis tendon, w weeks, m months, AN accessory navicular

Fig. 47.2 Excision and reattachment of accessory navicular bone



They observed that 77 % of patients reported ‘excellent’ outcomes after an average 12 years (range from 2 to 22 years). This was subjective patient rating of having ‘painless feet and had no shoeware problems’. Seven percent of the patients reported less than good outcome; experiencing ‘mild foot pain with activity but not restricting activity plus or minus shoeware modification’ or ‘moderate foot pain restricting activity plus or minus shoeware modification’.

Kiter et al. reported on the outcome of excision of the accessory bone plus rasping of the remaining bone in patients aged 14–36 year old [12]. After a mean of three years (range 2–5), 11 out of 17 reported no pain, no restriction to activity and no shoeware modification. Excision resulted in improvement of pain and footwear, but it was noticed that patients with flatfoot and not able to perform single-heel rise test before the surgery still could not perform the test after surgery [12, 16]. This may be due to the older population in their studies. Following this observation, Kiter et al. suggested that excision alone is unwise in patient flatfoot [12].

Kidner Procedure

Kidner procedure involved shelling out of the accessory navicular bone and release of posterior tibialis tendon insertion with a thin layer of bone which is then reattached to the undersurface of the navicular body [19]. Modifications of the

technique of tendon release and fixation is recognised. Patients were immobilised in below knee cast following this procedure for 4–6 weeks [7, 13–15, 17, 19, 20]. Series of patients undergoing excision of accessory navicular and reattachment of posterior tibialis tendon reported ‘good’ results and improved AOFAS midfoot scores [15, 17]. Despite reattachment of the tendon, Prichasuk and Sinphurmsukskul only observed that three out of 25 patients with flexible flat-foot had improved arch after the surgery [17]. Similar to some reports, their patients included patients of older aged group [12, 16].

Excision vs. Kidner Procedure

Macnicol and Voutsinas reported positive outcomes in patients with symptomatic accessory navicular undergoing Kidner procedure or simply excision [7]. Both groups of patients experienced improvement in pain. In contrast to other more recent reports [12, 16, 17], 14 of 26 flatfeet improved in shape following Kidner procedure. However, there were more complaints of protracted medial pain post-operatively after Kidner procedure [7].

There were improvements in study methodology in the recent years. In a prospective non-randomised comparison of 25 consecutive excisions with postoperative insoles and 25 consecutive Kidner procedures with postoperative casting,

Cha et al. reported improvement in both AOFAS midfoot scores and Visual Analogue Scale for pain with no statistical significance between both groups [13]. They also reported similar rate of restoration of medial longitudinal arch in both groups.

In another retrospective study, Pretell-Mazzini et al. reported no statistically significant difference in the subjective reported outcomes between patients undergoing excision (93 % good-to-excellent outcome) or Kidner procedure (83 % good-to-excellent outcome) [20]. They also reported more complications in patients undergoing Kidner procedure namely painful scar and tendinitis. There were four reoperations for painful scar, three of which following Kidner procedure.

Arthrodesis

Scott et al. prospectively evaluated 20 patients undergoing fusion of the accessory navicular using 3.5 mm cannulated screw [19]. The surgical technique was changed to a modified Kidner procedure after 10 patients due to technical difficulty where the large size of the metalwork split the accessory bone. Comparison of the two groups of surgical technique showed improvement in the final AOFAS midfoot scores but not statistically different. They noted three cases of progressive loss of the medial longitudinal arch with recalcitrant medial midfoot pain in the Kidner group.

Percutaneous Drilling

Nakayama et al. experienced non-union and metalware complications after attempted fusion using screw [6]. Hence, they performed percutaneous drilling under radiological guidance. A 1.0 mm K-wire was introduced from posterior prominence on the accessory navicular to the primary navicular through the synchondrosis at five to seven points. The foot was then immobilised a below knee cast for 3 weeks. Their 29 subjects consisted of adolescents aged 10–18 and 79 % reported returning to sports within three months. There were 43 % cases reported to be non-union but all reported improvement in symptoms (92 % good to excellent, 8 % fair). No patients reported a worse outcome or complication. One potential disadvantage of this procedure was there may be residual symptom from the prominent bone [21] but which may also not be solved by excision [18, 22].

Accessory Navicular and Flatfoot

A patient with flatfoot and symptomatic accessory navicular bone can present challenge to treatment, partly due to incomplete understanding of the cause and effect relationship

Table 47.2 Table of recommendation

Statement	Grade of recommendation
First line treatment for symptomatic accessory navicular bone in paediatric patients is non-operative	C
Associated flatfoot deformity is a predictor of less favourable outcome with surgery and may require treatment as well	I
Excision is the preferred surgical option for symptomatic accessory navicular	B
Percutaneous drilling is an effective, least invasive surgery for symptomatic Type 2 accessory navicular	I

between these two Phenomena. In the adolescence, non-operative management would aim to correct the flatfoot with symptomatic relief of the accessory navicular in parallel with the natural development of the medial longitudinal arch. In cases of protracted symptoms, Garras et al. retrospectively reported improved AOFAS hindfoot and VAS scores at least 2 years after subtalar arthroereisis performed with modified Kidner procedure in patients with flexible flatfoot aged between 10 year old and 27 year old [14]. In the younger patient group aged 10–16 year old with severe flexible flatfoot, modified Kidner procedure was supplemented with calcaneo-cuboid-cuneiform osteotomy [23]. Post-operative outcomes in pain, appearance and functional capacity were significantly improved at one-year follow-up.

Prognosis

Majority of patient satisfaction at one-year following surgery for symptomatic accessory navicular were favourable in case series reporting on surgical outcomes following a period of non-operative management [6, 7, 12–20, 23]. There had been no demonstrable significant difference in the outcomes between excision surgery and Kidner procedure. However, one need to consider there is no good quality study to support or dispute surgery or non-operative management. Most studies were limited in the small number of cases, long duration of patient recruitment, heterogenous patient characteristics and variations of named procedure.

Common complications following excision or Kidner procedure were residual prominence, scar problems such as pain, superficial wound inflammation and recurrence of accessory navicular [7, 18, 20–22].

Table 47.2 provides a list of recommendations for treatment of accessory navicular bone.

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