Surgical Treatment of Symptomatic Accessory Navicular in Children and Adolescents

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Abstract

Although an accessory navicular (AN) is present in approximately 10% of the population, it rarely is symptomatic, and few cases necessitate operative intervention. When symptoms require surgical treatment, excision of the AN, with or without advancement of the posterior tibial tendon, usually is successful.

We reviewed our records to evaluate the outcomes and complications of surgical treatment of AN. Retrospective chart review identified patients younger than 18 who were treated surgically for a painful AN between 1991 and 2012. Medical records and digital images were reviewed to determine demographic information, duration of symptoms before surgery, type of AN, presence of flatfoot deformity, type of surgery, length of follow-up, outcomes, and complications.

Twenty-seven patients (32 feet) had either isolated excision (14 feet) or excision plus tendon advancement (18 feet). Overall, 28 (87.5%) of feet had excellent or good functional outcomes. There was no significant difference in outcomes between the 2 procedures, though there was a trend toward more complications and more reoperations after tendon advancement.

The accessory navicular (AN) is a supernumerary foot bone that is present in 10% to 14% of the population.[1,2] Most ANs are asymptomatic, but some become painful, usually in late childhood or early adolescence. The most common symptom is a painful bony prominence, in the plantar-medial aspect of the foot, that causes problems with shoe wear or limits activity. Initial management of a painful AN is usually nonoperative. If an adequate trial of nonoperative treatment fails to relieve symptoms, excision of the AN is successful in decreasing pain and improving function in most patients.[3-9] Kidner[10] suggested that the abnormal insertion of the posterior tibial (PT) tendon on the AN disrupts the normal biomechanics of the tendon and results in a weak longitudinal arch and flatfoot. According to this theory, simple excision of the AN is insufficient treatment, and advancement of the tendon is required as well.[10-12]

To evaluate the outcomes and complications of surgical treatment of AN, with or without tendon advancement, we reviewed the records of patients who had an AN treated surgically at our institution during a 20-year period.

Materials and Methods

After obtaining institutional review board approval, we performed a records search to identify patients younger than 18 who had a diagnosis of AN and, after failure of nonoperative treatment, were treated operatively at our institution. For patients who met the inclusion criteria, medical records and digital images—PACS (picture archiving and communication system) software—were reviewed to determine demographic information, duration of symptoms before surgery, type of AN, and length of follow-up. Preoperative weight-bearing radiographs (if available) were analyzed for talonavicular coverage angle, Meary line, and calcaneal pitch. Preoperative variables assessed included pain location (either only in the medial arch or in the arch and in other areas of the foot/ankle), activities that exacerbated pain, difficulty with shoe wear, fatigue/tiredness in the affected limb, presence of Achilles tendon tightness, and associated flatfoot. Operative notes were reviewed to determine postoperative quantitative variables, including type of surgical procedure or procedures performed (AN excision, lateral column lengthening, calcaneal osteotomy, and/or Achilles tendon lengthening). Follow-up notes were reviewed to determine the functional outcome variables and complications (infection, wound issues, reoperations). Functional outcome was graded on the ability to return to daily activities as well as recreational and athletic activities. Functional outcome variables were graded category 1 (able to perform sports activities), category 2 (able to perform daily activities), or category 3 (pain and/or limitation in sports or daily activities). A category 3 outcome was considered a treatment failure.

Distribution of frequencies was used to describe qualitative variables and the mean for quantitative variables. The outcome variables were described by percentages. The χ^2 test or the Fisher test was used to analyze outcome variables, including presence or absence of flatfoot deformity and the surgical pro-

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cedure performed (AN excision with or without PT tendon advancement). Statistical analyses were conducted using STATA 10.0 software (StataCorp, College Station, Texas), and $P < .05$ was considered statistically significant for all analyses. Post hoc power analysis was calculated on the percentage of successful outcomes in patients who had isolated excision versus those who had excision with tendon advancement.

Results

Patient Demographics

Thirty patients with an AN were treated operatively between January 1991 and July 2012. Of these, 27 patients had sufficient records and radiographs; 3 were lost to follow-up. Mean age of the 5 boys and 22 girls was 13.2 years (range, 9 to 16 years) at time of surgery. The most frequent symptoms were pain and activity limitations (23 patients, 85%), with 13 of these patients reporting sports-related pain. Only 4 patients (15%) reported shoe-related discomfort. Mean duration of symptoms before surgery was 10 months (range, 2 to 36 months).

Thirteen patients had an AN in only 1 foot, and 14 patients had bilateral involvement, for a total of 41 feet. Of these feet, 32 (20 unilateral, 6 bilateral) were surgically treated, 18 left feet and 14 right feet. According to the commonly used classification[5,8] (**Figure**), 2 feet were type 1, 26 were type 2, and 4 were type 3. Eighteen (56%) of the 32 feet had associated flexible flatfoot deformities.

Radiographs

Weight-bearing preoperative radiographs were available for 19 patients (22 feet). Two distinct groups of patients were present, those with abnormal findings obviously indicative of flatfoot deformity, and those with otherwise normal radiographs. In the 4 patients (5 feet) with abnormal radiographs, mean (SD) radiographic parameters were as follows: talonavicular coverage angle, 19.5° (11.7°); Meary line, 16.5° (4.8°); and calcaneal pitch, 12.4° (4.7°). The other 15 patients (17 feet) had otherwise normal-appearing radiographs with mean (SD) parameters as follows: talonavicular coverage angle, 4.2° (3.1°); Meary line, 3.4° (3°); and calcaneal pitch, 22.9° (5.5°).

Surgical Procedures

The AN was excised in all 32 feet. In 14 feet, the PT tendon was split and then repaired; in the other 18 feet, the PT tendon was rerouted to a more plantar position (Kidner procedure). Presence or absence of a flatfoot deformity appeared not to influence choice of procedure. Of the 18 feet with flatfoot deformity, 10 (56%) had PT tendon advancement, and 8 (44%) did not, similar to the distribution in the 14 feet without flatfoot deformity: 8 (57%) had PT tendon advancement, and 6 (43%) did not. Any persistent medial prominence of the navicular tuberosity was resected with an oscillating saw, osteotome, or rongeur, according to surgeon preference. Additional procedures, lateral column lengthening and Achilles tendon lengthening, were performed in 1 of the 18 feet with flexible flatfoot deformity. All patients, regardless of procedure performed, wore a short-leg cast for 4 to 6 weeks after surgery. Generally, patients who had only excision were allowed touch-down weight-bearing in the cast, and patients who also had PT tendon advancement were kept non–weight-bearing.

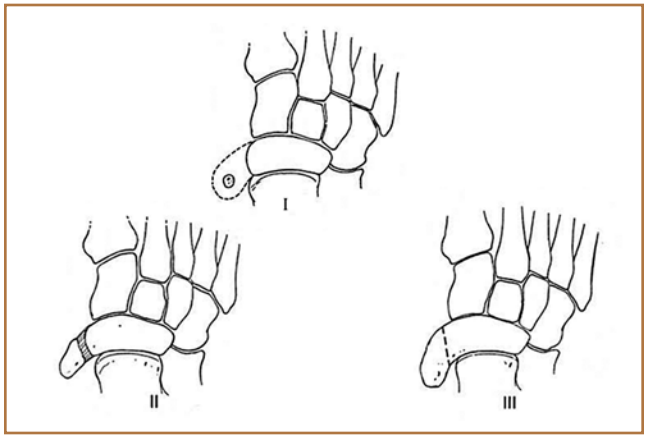

Figure. Classification of accessory navicular. Type 1, small oval-to-round ossicle within posterior tibial tendon; no bony or cartilaginous attachment to navicular. Type 2, larger lateral projection from medial aspect of navicular; fibrocartilaginous plate less than 2 mm wide and with irregular outline separates tuberosity from body of navicular. Type 3, "horn"-shaped prominence connected to navicular by bony bridge.

Outcomes

Overall, excision of the AN was successful in 28 (87.5%) of the 32 feet, regardless of the procedure used for the PT tendon. Twenty-four (75%) of the 32 feet were graded category 1 outcomes (able to perform sports activities), 4 were category 2 (able to perform daily activities), and 4 were category 3 (pain and/or limitation in sports or daily activities). Complications (painful scar formation, tibial tendinitis) occurred in 9 feet (28%), but only 4 (12.5%) required reoperation. All 4 reoperations were scar revisions.

Isolated excision of the AN through a PT tendon split was successful in 13 (93%) of 14 feet; 1 of the 14 required reoperation because of a painful scar. A painful scar was reported in 1 other foot but did not require treatment; 1 patient had PT tendinitis. Twelve of these 14 feet were graded category 1, and 1 each categories 2 and 3.

Excision of the AN and advancement of the PT tendon were successful in 15 (83%) of 18 feet. Complications occurred in 6 feet (4 painful scars, 2 tendinitis); 3 required reoperation. Twelve feet were graded category 1, 3 feet were category 2, and 3 feet were category 3 (**Table I**).

There were no significant differences in complications, reoperations, functional status, or failure of treatment between the 2 tibial tendon procedures. The 1 patient who had lateral column lengthening and tendo-Achilles lengthening had a category 1 functional outcome. Length of postoperative immobilization and timing of weight-bearing did not appear to influence outcome.

Table I. Outcomes of Surgical Treatment of Accessory Navicular

	Excision Plus Tendon Advancement (n = 18)	Isolated Excision (n = 14)
Flatfoot deformity	10 with 8 without	8 with 6 without
Type of accessory navicular[a]	0 type 1 16 type 2 2 type 3	2 type 1 8 type 2 4 type 3
Complications	4 painful scars 2 tibial tendinitis 6 total	2 painful scars 1 tibial tendinitis 3 total
Reoperation	3	1
Functional status[b]	12 category 1 3 category 2 3 category 3	12 category 1 1 category 2 1 category 3

[a]See Figure.
[b]Categories: 1, able to perform sport activities; 2, able to perform daily activities; 3, pain and limitations when performing either sports or daily activities.

Table II. Outcomes of Accessory Navicular Excision in Patients With and Without Flatfoot Deformity

	Flatfoot Deformity		
Variable	**Yes (n = 18)**	**No (n = 14)**	***P***
Complications			.632
Yes	5	4	
No	13	10	
Reoperation			.597
Yes	2	2	
No	16	12	
Functional status category[a]			.596
1	12	12	
2	3	1	
3	3	1	
Treatment failure			.238
Yes	3	1	
No	15	14	

[a]Categories: 1, able to perform sport activities; 2, able to perform daily activities; 3, pain and limitations when performing either sports or daily activities.

Of the 14 patients with bilateral AN bones, 6 had bilateral procedures, and 4 had excision of the contralateral AN planned because of pain. Of the other 4 patients, 2 developed symptoms in the contralateral foot and required excision of the AN.

Furthermore, type of AN did not appear to have any effect on outcome, though the number of patients in each group was too small to draw any meaningful conclusions. There were no statistically significant differences in functional outcomes or complications between patients with flatfoot deformity and those without (**Table II**); however, 3 of the 4 treatment failures were in patients with flatfoot deformities.

Discussion

Although most ANs are asymptomatic, they can cause pain and functional limitation, especially in young active patients.[1,2] Of our 27 patients, 23 (85%) complained of pain with physical activities, and nearly half reported being unable to participate in sports activities because of the AN. Initial treatment usually is nonoperative, involving activity and shoe-wear modifications, casting, and use of nonsteroidal anti-inflammatory drugs. Operative treatment is indicated if conservative treatment fails to relieve symptoms. Operative treatment usually involves excision of the AN with or without advancement of the PT tendon. Advancement of the tendon to a more plantar position was advocated by Kidner,[10] who suggested that the abnormal insertion of the PT tendon on the AN produced weakness of the longitudinal arch and a resultant painful flatfoot deformity. Several more recent studies have found equally good results with excision of the AN and repair of the split tendon.[3-9] We found no statistically significant differences in complications, reoperations, functional status, or treatment failures between the 2 procedures. There was, however, a trend toward more complications in the tendon advancement group (6/18 feet) than in the isolated excision group (3/14 feet). Three feet in the tendon advancement group and 1 foot in the isolated excision group required reoperation because of painful scarring.

In children, excellent or good results have been reported in 85% up to 96% of feet treated with isolated excision of the AN[3-6,9,11] and in 70% to 90% of feet treated with excision and tendon advancement.[4,8,9,12] In our series, isolated excision resulted in category 1 functional status (able to perform sports activities) in 12 feet and category 2 status (able to perform daily activities) in 1 other foot, giving a good-to-excellent outcome in 13 (93%) of 14 feet. Excision plus tendon advancement resulted in category 1 functional status in 12 feet and category 2 status in 3 other feet, giving a good-to-excellent outcome in 15 (83%) of 18 feet.

Bilateral ANs have been described in 8% to 68% of patients.[1-3,5] In our series, 14 patients (52%) had bilateral ANs. Surgery was performed on or planned for the symptomatic feet in all cases. Both feet were symptomatic in 10 patients, and 1 foot was symptomatic in the other 4. Of the 4 patients with unilateral symptoms, 2 went on to develop symptoms in the contralateral foot, 10 and 24 months later, respectively. Although these numbers are small, they suggest that the presence of a contralateral AN and the possibility that it will become symptomatic and require treatment should be discussed with patients and parents.

This study had its limitations. First, the retrospective design is inherently biased. Second, the flatfoot diagnosis was primarily clinical and not based on radiographs. Although 4 of 5 patients with abnormal radiographs were correctly diagnosed

with flatfoot, only 10 of 17 patients with normal-appearing radiographs had flatfoot ruled out. Third, the relatively small sample size significantly underpowered the study. Post hoc power analysis based on percentage of successful outcomes of simple excision versus excision and tendon advancement yielded a β of 11%. Assuming similar rates of successful outcomes in each group (93% for simple excision, 83% for excision and advancement), 182 patients would be needed in each group to achieve a β of 80%.

These results confirm that the high rate of successful outcomes of isolated excision of an AN equals or exceeds the rate of successful outcomes of excision plus tendon advancement. As this study was not randomized, factors other than choice of procedure may have influenced outcomes. Both procedures have infrequent complications, but painful scarring may require reoperation.

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References

1. Lawson JP, Ogden JA, Selia E, Barwick KW. The painful accessory navicular. *Skeletal Radiol*. 1984;12(4):250-252.
2. Ugolini PA, Raikin SM. The accessory navicular. *Foot Ankle Clin*. 2004;9(1):165-180.
3. Bennett GL, Weiner DS, Leighley B. Surgical treatment of symptomatic accessory tarsal navicular. *J Pediatr Orthop*. 1990;10(4):445-449.
4. Cha SM, Shin HD, Kim KC, Lee JK. Simple excision vs the Kidner procedure for type 2 accessory navicular associated with flatfoot in pediatric population. *Foot Ankle Int*. 2013;34(2):167-172.
5. Grogan DP, Gasser SI, Ogden JA. The painful accessory navicular: a clinical and histopathological study. *Foot Ankle*. 1989;10(3):164-169.
6. Kopp FJ, Marcus RE. Clinical outcome of surgical treatment of the symptomatic accessory navicular. *Foot Ankle Int*. 2004;25(1):27-30.
7. Macnicol MF, Voutsinas S. Surgical treatment of the symptomatic accessory navicular. *J Bone Joint Surg Br*. 1984;66(2):218-226.
8. Ray S, Goldberg VM. Surgical treatment of the accessory navicular. *Clin Orthop*. 1993;(177):61-66.
9. Scott AT, Sabesan VJ, Saluta JR, Wilson MA, Easley ME. Fusion versus excision of the symptomatic type II accessory navicular: a prospective study. *Foot Ankle Int*. 2009;30(1):10-15.
10. Kidner FC. The prehallux (accessory scaphoid) in its relationship to flatfoot. *J Bone Joint Surg Am*. 1929;11(4):831-837.
11. Kiter E, Gümal I, Turgut A, Köse N. Evaluation of simple excision in the treatment of symptomatic accessory navicular associated with flat feet. *J Orthop Sci*. 2000;5(4):333-335.
12. Lee KT, Kim KC, Park YU, Park SM, Lee YK, Deland JT. Midterm outcome of modified Kidner procedure. *Foot Ankle Int*. 2012;33(2):122-127.