

Accuracy of Injection Into the Basal Joint of the Thumb

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Abstract

To investigate the accuracy of intra-articular injection of the basal joint and to determine the rate of soft-tissue extravasation of injected material in successful intra-articular injection, we injected the basal joint of 30 hands with radiopaque dye (with fluoroscopy guiding needle placement in 8 cases) and then used fluoroscopy to check injection accuracy. Results were recorded depending on the location of the injected dye on fluoroscopic examination. Rates of intra-articular accuracy and soft-tissue extravasation for successful intra-articular injections were 100% and 25% for the fluoroscopy-guided group and 81.8% and 25% for the "blind" group. This study's accuracy rate for intra-articular injection of the basal joint is comparable to the rates reported for injection of larger joints. There is a relatively high soft-tissue extravasation rate for successful intra-articular injection.

Osteoarthritis of the thumb carpometacarpal joint is a common problem that causes significant disability and function loss.¹⁻⁶ Studies have identified moderate to severe degenerative disease of this joint in 16% to 21% of the female population.^{1,3} Osteoarthritis of the trapeziometacarpal joint of the thumb affects postmenopausal females 10 to 15 times more often than males of similar age.⁴ In addition, fewer than half of patients with degenerative changes evident on radiographs are symptomatic at this joint.³

Various treatments have been used for osteoarthritis of the thumb carpometacarpal joint. Operative treatments,

such as trapezium resection and ligament reconstruction, have been used for advanced symptoms recalcitrant to nonoperative modalities.^{1-4,7} Nonoperative treatments include splinting, use of oral nonsteroidal anti-inflammatory drugs, and activity modifications.^{1,4,8} Intra-articular medication has been widely used in the treatment of osteoarthritis of other joints^{4,8-11}; it is also used in the treatment of basal joint arthritis.^{4,8,12}

Accuracy of needle placement into the knee and into other large joints has been investigated recently.^{10,12} To our knowledge, accuracy of injection into the basal joint of the thumb has been infrequently studied.¹² In the study reported here, we investigated the accuracy of injection of the basal joint of the thumb as well as the rate of soft-tissue extravasation.

MATERIALS AND METHODS

The study population consisted of 30 intact upper extremity specimens from 16 cadavers (7 male, 9 female). Mean age was 74.4 years (range, 46-92 years).

Injections of the basal joint of the thumb were attempted by 2 fellowship-trained hand surgeons using a method similar to that described in the literature.⁸ A 25-gauge 1.5-in needle was introduced into the base of the first metacarpal close to the first extensor compartment. The needle was directed toward the proximal portion of the fourth metacarpal and was advanced until there was a perceptible puncture of the presumed joint capsule (Figure 1). Diatrizoate meglumine and diatrizoate sodium dye (Hypaque-76; Nycomed Inc, Princeton, NJ) was injected until there was palpable resistance to flow (0.2-0.5 mL). Posteroanterior and lateral views of the basal joint were



Figure 1. Injection method, with needle insertion along the border of the snuffbox.

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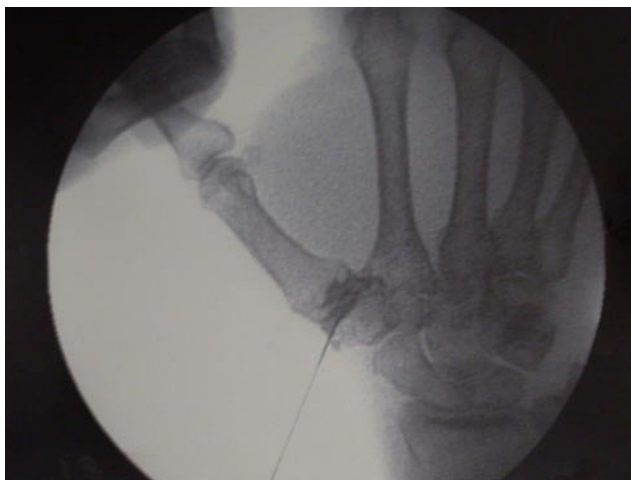


Figure 2. Fluoroscopic image of successful intra-articular injection without soft-tissue extravasation.

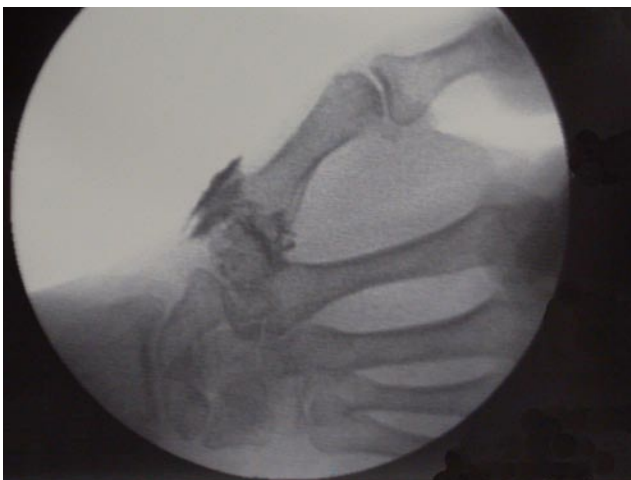


Figure 3. Fluoroscopic image of successful intra-articular injection with soft-tissue extravasation.

obtained with a portable image-intensifier to verify the location of the dye. Dye location was classified as *intra-articular* (dye completely within the joint; Figure 2), *intra-articular with soft-tissue extravasation* (dye within the joint and in the soft tissues surrounding the joint; Figure 3), or *soft tissue only* (dye completely in the soft tissues, no dye within the joint; Figure 4).

Fluoroscopy was used to guide injection of 8 specimens in an attempt to duplicate ideal conditions and thus create an intra-articular injection “gold standard” for comparison purposes. To approximate conditions in most outpatient clinics and physician offices, we injected the other 22 specimens without fluoroscopy-guided needle placement.

RESULTS

The Table summarizes the injection results of the fluoroscopy-guided and “blind” needle placements.

Rates of intra-articular needle placement, 100% for the fluoroscopy-guided group and 81.8% for the blind group, were analyzed with the Fisher exact test. The rate difference was not statistically significant ($P = .546$). Rates of



Figure 4. Fluoroscopic image of unsuccessful injection with dye present only in the extra-articular soft tissues.

soft-tissue extravasation of dye for successful intra-articular injections were 25% (fluoroscopy-guided) and 33.3% (blind).

DISCUSSION

For intra-articular injection, accurate placement of the needle within the joint capsule is an important issue. Effectiveness of injected medications is related to successful introduction of the agent into the joint space. Potential problems associated with failure of a corticosteroid injection to reach the joint include fat atrophy, reduced skin pigmentation, and possible weakening of the tendons or ligaments.⁴ Another possible application for intra-articular injection of the basal joint of the thumb could be use of the viscosupplementation preparations currently used in the knee.

In the only study addressing the accuracy of intra-articular injection of the basal joint,¹² 3 injections were attempted, and verification of success was made by aspiration of synovial fluid. (Because of the relatively small size of the thumb carpometacarpal joint and the small amount of synovial fluid usually in this region, aspiration of synovial fluid is, understandably, difficult.) The investigators reported 1 extra-articular injection and 2 “uncertain” injections. The injection method was not described.

Reported rates of accuracy of injection into the knee joint range from 71% to 100%.¹⁰ Our rates of accuracy of intra-articular injection into the basal joint of the thumb, 100% for fluoroscopy-guided injection and 81.8% for blind injection, compare favorably with reported rates of knee injection accuracy. Accuracy of other needle placement techniques for the carpometacarpal joint is likely similar. However, it is difficult to speculate on the actual applicability of these results to the accuracy of other needle placement techniques for the basal joint without conducting another comparison study.

The implications for drug extravasation into the surrounding extra-articular space are presumably similar to those cited for failed needle placement. Therefore,

Table. Accuracy of Basal Joint Injections

Injection Method	Total No. Injections	Dye Location			% of Extravasation of Intra-Articular Injection	Accuracy of Intra-Articular Injection
		Joint Space Only	Joint Space + Soft Tissue	Soft Tissue Only		
Fluoroscopy-guided	8	6	2	0	25%	100%
Blind	22	12	6	4	33%	81.8%

injecting a drug at an appropriate volume is highly recommended. In this study, 0.2 to 0.5 mL were injected, and a palpable endpoint was difficult to detect. Anecdotally, more fluid (2 mL) is typically injected into the basal joint. Forcing excess fluid into the joint space may induce a painfully distended capsule. Care must be exercised during injections to prevent excessive internal pressurization of the capsule.

Shortcomings of this study include using preserved cadaveric specimens for injection. Surface anatomy is more difficult to identify in stiff, embalmed specimens. There is also limited joint mobility in cadaveric specimens, making injection more difficult than in live or fresh-frozen specimens. We speculate that accuracy is improved in the absence of embalmed, brittle tissue. Another encountered difficulty is the contracted, stiff nature of the joint capsule with volume loss—which may help account for our groups' rates (25%, 33%) of minor soft-tissue extravasation of dye.

CONCLUSIONS

This study examined the accuracy of injection into the basal joint of the thumb of 30 cadavers with and without the aid of a portable image-intensifier. Accuracy for blind injection into this relatively small joint was comparable with what has been reported for large joints.

AUTHORS' DISCLOSURE STATEMENT AND ACKNOWLEDGMENTS

The authors report no actual or potential conflict of interest in relation to this article.

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