Original Article

Improved Network Integrity and Patient Follow-up After In-Office Needle Arthroscopy Compared to Outpatient Advanced Diagnostic Imaging for Intra-articular Pathology

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Purpose: To evaluate network integrity for diagnostic testing and patient follow-up comparing in-office needle arthroscopy and outpatient advanced diagnostic imaging for intra-articular pathology. **Methods:** A retrospective chart review was performed to identify patients who were indicated for either in-office needle arthroscopy (IONA) or outpatient advanced diagnostic imaging (OADI). *Current Procedural Terminology* (*CPT*) codes 29870 and 29805 with place of service modifier 11 were used to identify patients who underwent IONA of the knee and shoulder, respectively, between January 2020 and March 2023. *CPT* codes 73721-3 and 73221-3 were utilized to identify patients indicated for outpatient advanced magnetic resonance imaging of the knee or shoulder. All patients who were indicated for the procedure and denied by the insurance were identified and recorded. Inclusion criteria consisted of patients older than 18 years with suspected intra-articular pathology who had failed conservative treatment. Exclusion criteria included patients younger than 18 years, non-English speaking, or those who failed to follow up due to death. The location of where the imaging was performed was recorded (within the health system vs an unaffiliated center). Additionally, patient follow-up with the provider after the diagnostic testing was indicated was recorded. **Results:** Two separate groups of 100 consecutive patients who were indicated for IONA or OADI were identified and retrospectively chart reviewed. Ninety-four percent of the IONA patients underwent the procedure after it was indicated within the physician office. Sixty-eight percent underwent the procedure the day they were indicated for the procedure. All 94 patients were deemed to have a follow-up with a definitive plan of care after the procedure. Eighty-seven percent of the OADI patients completed their ordered testing. Sixty-two percent (54/87) of the patients had the study performed at one of the primary hospital-affiliated imaging centers. Thirty-eight percent of the studies (33/87) were deemed to have leaked from the system. Of the 87 patients who had the imaging performed, 79% (69/87) had a definitive treatment plan rendered with the lead author (S.M.) based on the imaging results. Twenty-one percent (18/87) of the patients who underwent imaging did not follow up with the treating provider or show for a scheduled follow-up appointment. Nineteen percent (13/69) of the patients who had a definite treatment plan rendered did not come into the office for their results but requested and received them over the phone from the provider. The IONA cohort demonstrated statistically significant ($P < .001$) network integrity in terms of location of service remaining within the system compared to the OADI group. Furthermore, patient follow-up for definitive treatment plans after IONA was also higher ($P < .001$) than in the OADI group. **Conclusions:** IONA results in greater network integrity and patient follow-up compared to conventional imaging. **Clinical Relevance:** In-office needle arthroscopy performed for the diagnosis of intra-articular pathology may offer a valuable clinical diagnostic tool while providing a meaningful avenue for network integrity and patient retention.

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The current climate of US health care has been improving the patient experience and access to care, all while decreasing physician and hospital reimbursement margins. As such, the concepts of patient retention and network integrity have been driving factors of private practice and system leaders. Network integrity has been defined as the "ability to keep patients within your defined network of providers who are employed, affiliated, or in some way aligned with your organization. This could include a hospital, employed medical group, an ACO, CI network, or an independent physician organization."[1] A 2011 report documented health systems and provider organizations can experience upward of 50% to 60% of care going out of system.[2] This occurrence has been termed "leakage" and has been associated with lost revenue, fragmented or delayed care, and potential loss of patient retention to the treating health care system or provider group.

In the context of advanced diagnostic imaging, Prabhakar et al.[3] reviewed 36,022 patients who underwent either computed tomography (CT) or magnetic resonance imaging (MRI). A total of 11,234 (31.2%) imaging studies were leaked outside the home institution, with 3,513 (9.8%) examinations performed at affiliated hospitals and 7,721 (21.4%) performed at nonaffiliated hospitals and imaging centers. Several barriers to network integrity have been described. These include patient cost factors, office delay in authorizations, location, appointment availability, and lack of physician buy-in network integrity.[4,5] Furthermore, a delay in timely scheduled follow-up appointments for imaging review may lead to potential patient loss from network.

In-office needle arthroscopy (IONA) is an emerging diagnostic technology that allows for intra-articular inspection. Initial indications included patients who were unable to have MRI performed due to metal implants or claustrophobia. However, with technologic advances, IONA has become an option to orthopaedic surgeons who suspect internal derangement within the knee and shoulder.[5,6] This opportunity for immediate answers has been shown to decrease patient diagnosis wait time by up to 2 weeks compared to traditional MRI.[7]

While leakage is a recognized concern for private practices and health care systems, little has been discussed in the literature from an in-office procedure side to determine if the risk can be minimized.[8] The purpose of this study was to evaluate network integrity for diagnostic testing and patient follow-up comparing IONA and outpatient advanced diagnostic imaging (OADI) for intra-articular pathology. Our hypothesis was that there would be less leakage for patients undergoing IONA for the diagnosis of their intra-articular pathology versus those who went for MRI or CT. We further hypothesize that there would be higher follow-up in the IONA cohort than in the OADI group.

Methods

Study approval was obtained from the local hospital institutional review board. Retrospective chart review was performed from January 1, 2020, through March 1, 2023, examining patients who were indicated for either IONA or ordered outpatient advanced diagnostic imaging OADI. *Current Procedural Terminology* (*CPT*) codes 29870 and 29805 with place of service modifier 11 were used to identify patients who underwent IONA of the knee and shoulder, respectively. *CPT* codes 73721-3 and 73221-3 were utilized to identify patients indicated for OADI in the form of MRI of the knee or shoulder. Inclusion criteria consisted of patients older than 18 years, English speaking, and suspected intra-articular pathology that had failed conservative treatment. Exclusion criteria included patients younger than 18 years, non-English speaking, suspected non-intra-articular pathology, or failure to follow up due to death. All patients who were indicated for the either diagnostic modality and denied by the insurance were identified and recorded.

For patients undergoing OADI, the process for approval was handled by an authorization specialist within the office. Once authorized, the patients were contacted and informed of approval and locations within the health care network where they could have the imaging performed. They were instructed to call for a follow-up appointment to review the results once their imaging was completed. For patients who required prior authorization for IONA, authorization was obtained by the lead author's (S.M.) surgical scheduler, and the patient was contacted for a follow-up appointment once approved. Follow-up was tracked for all patients who made follow-up appointments. The follow-up time period was deemed to be 90 days from the time if being indicated for either IONA or OADI.

The location of where the imaging was performed was recorded (within the health system vs an unaffiliated center). Additionally, tangible patient follow-up with the provider after the diagnostic testing was indicated was recorded. This was defined as a follow-up office visit, a patient-physician phone call, or telehealth visit. All data were recorded, deidentified, and stored in a secure manner. Statistical analyses comparisons were performed on diagnostic procedure completion rates between the 2 patient groups. For analyses, R version 4.2.2 was used.[9] Confidence intervals were estimated with the ratesci package.[10] The Newcombe method (based on the Wilson score) was employed to estimate confidence intervals (CIs) for

Table 1. Statistical Significance of Network Integrity for IONA Within the Health System Compared to OADI

	DP, % (n)				
Completion Rate	IONA (N = 100)	MRI or CT Scan (N = 100) [Reference Group]	RD (95% CI), %	χ^2	P
DP at any facility	94 (94/100)	87 (87/100)	7.0 (−1.2 to 15.8)	2.84	.092
DP at hospital-affiliated facility	94 (94/100)	54 (54/100)	40.0 (29.0 to 50.6)	41.37	<.001
Treatment plan	94 (94/100)	69 (69/100)	25.0 (14.9 to 35.4)	20.62	<.001

NOTE. Statistical significance was also found for the IONA group pertaining to follow-up for definitive treatment planning compared to the OADI group.

CI, confidence interval; DP, diagnostic procedure; IONA, in-office needle arthroscopy; RD, rate (percentage) difference.

differences in proportions, χ^2 statistics, and significance levels.[11,12]

Results

One hundred consecutive patients were identified in both the IONA and OADI groups. The IONA cohort demonstrated statistical significance ($P < .001$) for the diagnostic imaging procedure being performed within the system compared to the OADI group (Table 1). Furthermore, patient follow-up for definitive treatment plans after IONA was statistically significant ($P < .001$) in comparison to the OADI group. In the IONA group, 94 of 100 patients underwent the in-office procedure once indicated. Of these 94 patients, 64 underwent the procedure the day they were seen or indicated for the procedure. Thirty-four patients required authorization and all but 4 returned within 1 week for the procedure. Ninety-four percent (94/100) of the procedures were performed by the lead author (S.M.) within the hospital employed office facility. All 94 patients were deemed to have a follow-up with a definitive plan of care created after the procedure. This treatment included recommendation for definitive surgical procedure, physical therapy, injection, or other documented plan of care. Of the 6 who did not undergo the procedure, 4 patients were denied authorization by the insurance company and 2 patients did not return for the procedure after authorization was obtained.

In the OADI group, 87 of 100 patients completed their ordered testing. Sixty-two percent (54/87) of the patients had the study performed at one of the primary hospital-affiliated imaging centers. Thirty-eight percent (33/87) had their imaging performed outside of the system. Of the 87 patients who had the imaging performed, 79% (69/87) had a definitive treatment plan rendered with the lead author (S.M.) based on the imaging results. Twenty-one percent (18/87) of the patients who underwent imaging did not follow up with the treating provider or show for a scheduled follow-up appointment. Nineteen percent (13/69) of the patients who had a definite treatment plan rendered did not come into the office for their results; rather, they requested and received their results over the phone from the provider. No definitive explanation was provided for the 13% (13/100) of patients who did not obtain advanced imaging.

Discussion

In-office needle arthroscopy, performed as a diagnostic imaging tool for intra-articular pathology, demonstrated statistically significant ($P < .001$) network integrity in terms of location of service remaining within the system compared to the OADI group. Furthermore, patient follow-up for definitive treatment plans after IONA was also higher ($P < .001$) than in the OADI group. In our study, we reviewed 100 consecutive patients who were indicated for IONA and 100 who had OADI ordered for intra-articular pathology related to the knee and shoulder. In the IONA group, 94% of the patients underwent the diagnostic procedure. All IONA procedures were performed within the practice by the lead author (S.M.) . At the conclusion of the procedure, all 94 patients had a definitive plan of care devised. This entailed either a surgical plan or a decision to pursue alternative nonoperative modalities. The result is a 94% network integrity retention for the diagnostic modality and subsequent follow-up. Overall examination of the IONA group found only a 6% loss of advanced imaging or failure of follow up to the system.

In the outpatient diagnostic imaging group, 87% of the patients completed the ordered advanced imaging. However, only 62% (54/87) of these patients had the service performed within hospital-owned or hospital-affiliated imaging centers. Furthermore, only 79% (69/87) of those patients had follow-up contact with the treating provider group. Interestingly, 19% (13/69) of the patients who followed up did so without returning to the office for a follow-up appointment. Instead, the results were communicated at the patient's request, over the phone or via communication through electronic health record. Overall, 38% (33/87) of imaging performed in the outpatient diagnostic group was deemed to have leaked from the system. Twenty-one percent (18/87) of the patients who underwent the testing did not follow up with the treating provider or show for a scheduled follow-up appointment. In total, of the 100 patients who initially were prescribed

outpatient diagnostic imaging, 34% (34/100) returned to the office for the same medical issue within 90 days from their initial ordering visit. Network integrity and patient retention are 2 topics that currently shape the financial survival of health care practices in the face of decreasing reimbursement by insurance carriers. Diagnostic imaging is a staple of an orthopaedic workup for suspected intra-articular pathology. Annually, more than 10 million MRIs are performed on patients.[13] In an effort to control cost, there has been a rise in risk-share payment models and preferred imaging providers, but leakage from health systems and provider groups who own their own imaging machines still exists. Furthermore, patient follow-up after imaging is not guaranteed. Scheduling logistics of coordinating timely follow-up visits to review the images can lead to delays in patient care. Given the open access to imaging results afforded to patients by recent health care acts, many patients may choose to follow up elsewhere after obtaining their results on their own if it is more expeditious.

To maintain network integrity, many practices and health systems have attempted to streamline the scheduling process of diagnostic imaging. Nevertheless, faults still exist in the current systems, and it is estimated that up to 45% of patients will never make it to the referred destination.[1] The financial ramifications of this breakdown have been estimated at nearly $20 million in lost revenue annually for a health system when accounting for leakage outside of the network for OADI.[14,15] An alternative solution, particularly for patients with suspected intra-articular pathology, is IONA. IONA is performed under local anesthetic using a 14-gauge needle and provides arthroscopic visualization of the joint consistent with what surgeons are accustomed to in the operative theater. The sensitivity and specificity of identifying intra-articular pathology, such as meniscal tears, has been well documented, as has the patient tolerance profile.[6,16] Advances in current imaging chip technologies have allowed for clearer visualization compared to earlier generations (Fig 1). Additionally, IONA equipment, such as knee posts, shoulder distractors, and small joint instrumentation, has been developed to allow for procedure optimization. Typically, the patient is able to walk out of the office at the conclusion of the procedure without the need for crutches or a sling.

Arthroscopy has long been considered the gold standard for identifying intra-articular pathology. While a learning curve of approximately 15 cases exists for IONA, the validity of the modality with the appropriate indication has been established. Deirmengian et al.[6] found increased sensitivity and specificity for meniscal pathology with needle arthroscopy compared to MRI. Similarly, Wagner et al.[17] reported comparable accuracy with needle arthroscopy versus MRI for diagnosing

Fig 1. Pictured is an intra-articular view of a right shoulder in the lateral decubitus position utilizing a needle arthroscope. A clear image is visualized demonstrating the biceps tendon (star) and a partial thickness rotator cuff tear (arrow).

articular cartilage, labrum, rotator cuff, and biceps pathology. Furthermore, they found needle arthroscopy had better ability to "rule in" a diagnosis.

Nevertheless, a barrier to adoption still exists for many clinicians surrounding IONA. Concerns over clinic disruption by performing in-office needle arthroscopy is a common fear by physicians. However, integration of the procedure into an office workflow has been published and, with training and commitment, can lead to minimal short-term disruption compared to the long-term gain of patient capture and retention.[18] Once a treating physician has become proficient, the actual time to perform the procedure can be under 5 minutes. Additionally, the safety profile of IONA has been reviewed across more than 1,400 patients and found to be of no greater risk than standard in-office injections.[19]

Many factors can play a role in a patient's decision as to where they choose to obtain imaging and why. Cost, location, availability, convenience, and advertising/word of mouth are just a few possibilities. It is not plausible to assume that all patients indicated for advanced diagnostic imaging would stay within 1 network or office for their studies. While most patients have selected their chosen orthopaedic specialist and prefer to stay with that physician for care, some may choose to seek outside opinion once they obtain their results. A significant hurdle in patient retention is timely follow-up after imaging is completed. Factors associated with this include limited office

appointments, imaging authorization delays, and busy surgical schedules. All totaled, the delays in patient follow-up for imaging review may be deemed unacceptable to the patient and encourage outside consultation.

IONA in the lead author's (S.M.) practice has been successful in maintaining patient capture after a decision is made for advanced imaging. While reimbursement for IONA may vary across insurance carriers and regions, the cost of the disposable arthroscope for performing the procedure in the office setting continues to decrease, making the time and profit margins acceptable from a practice standpoint. Currently, Medicare and many commercial carriers do not require prior authorization. For carriers that do require authorization, many will approve IONA with proper documentation the same day as the visit. Additionally, the cost-savings benefit of IONA for patients has been previously established compared to MRI and MRI arthrogram.[19] Ford et al.[20] found cost savings on average of between $418 and $961 for knee and between $554 and $1,097 for shoulder IONA compared to MRIs. Discussion centering on the loss of revenue from advanced imaging for a health system or private practice that owns an MRI is valid. However, our current study highlights potentially significant revenue loss already exists for these entities based on network leakage and/or failure of patient follow-up. Based on this, IONA may present an interesting alternative for physicians who have a strong sense of positive intra-articular pathology based on history and examination. The potential cumulative financial benefit of capturing the imaging, follow-up, and potential surgery is a proposition that should be weighed in the right circumstance based on our data. Consideration of a prospective study with randomization of the procedures may provide further information and help dictate treatment algorithms moving forward.

Limitations

Limitations exist in our current study. This was a retrospective review performed at a single institution by a hospital-employed physician. As such, inherent biases based on system practice and principles for obtaining authorizations and scheduling exist. Variations do exist from practice to practice in how advanced imaging is authorized and follow-up appointments made. Imperfections in our own process have been identified and continue to be a work in progress for efficiency. Furthermore, feasibility and applicability from a hospital-employed setting compared to private practice must be considered. Additionally, the authors recognize the relatively small sample size examined, but given the narrow indications of IONA, the lead author's preference was to perform the procedure only in patients who were deemed clear candidates.

Conclusions

IONA results in greater network integrity and patient follow-up compared to conventional imaging.

Disclosures

The authors report the following potential conflicts of interest or sources of funding: R.F. reports a relationship with Arthrex Inc that includes consulting or advisory and speaking and lecture fees. S.M. reports a relationship with Trice Medical that includes equity or stocks and speaking and lecture fees and has a patent licensed to Trice Medical. All other authors (E.F., M.P.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. Full ICMJE author disclosure forms are available for this article online, as supplementary material.

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