

A Survey of Arthrocentesis and Soft-Tissue Injection Procedures Performed in Primary Care Practice: Effect of Resident Training and Using Data to Shape Curriculum

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ABSTRACT. *Objective.* The purpose of this study is (1) to survey graduates of our internal medicine program for use of musculoskeletal (MSK) procedures in primary care practice and assess the influence of participating in a first-year resident arthrocentesis and soft-tissue injection training course on their MSK procedure comfort/utilization; and (2) to use the results to modify our MSK procedure curriculum.

Methods. A questionnaire designed to assess numbers of, comfort with, and effect of resident training on MSK procedures in the preceding year was sent to 2002-2006 graduates of the internal medicine training program in outpatient primary care (OPC). Graduates practicing hospital medicine (HM) also received the questionnaire and served as a comparison group.

Results. There were 52 responses from this group of 84 graduates (64% response rate). OPC graduates (N = 32) were more comfortable doing procedures than those practicing HM exclusively (N = 20), and performed significantly more procedures in the preceding year (32.9 procedures per OPC/year vs 2.2 for HM). The most common procedures performed were knee joint, subacromial bursa, and trochanteric bursa, comprising > 75% of all procedures performed. A structured resident course in MSK procedures had a significant effect on the OPC physicians. Course participants (N = 17) performed almost twice the number of procedures/year as the nonparticipants (N = 15), were more comfortable with the procedures, and were significantly less likely to refer procedures to other clinicians. Written comments by respondents suggest additional MSK procedure training during and after residency is needed.

Conclusion. Our results suggest a structured resident course in MSK procedures has a longterm influence. A progressively more focused approach to training is needed. (First Release July 15 2011; J Rheumatol 2011;38:1986-9; doi:10.3899/jrheum.110041)

Key Indexing Terms:

TEACHING ARTHROCENTESIS MUSCULOSKELETAL INJECTION RESIDENTS

It is estimated that 1 in every 5 to 10 office visits to a primary care provider is for a musculoskeletal (MSK) disorder, and up to 30% of the population experiences symptoms of arthritis. Arthritis/back pain represents the second leading cause of acute disability, and is the number one cause of chronic disability in the general population¹. Rheumatologists are often called upon by their colleagues for their knowledge of MSK conditions and for assistance with MSK procedures. However, there is a current and progressive shortage of rheumatologists in both Canada and the US, and this shortage causes a transformation of the rheumatologist from an MSK specialist to an immunotherapist. This will further the need for skill transfer to primary care physicians to treat common MSK conditions².

Unfortunately, 30% to 60% of internal medicine and family practice residency directors rate their programs as inadequate in the area of teaching joint aspiration/injection skills³. Although most internal medicine residencies are able to meet the objective of the American Board of Internal Medicine for performing knee arthrocentesis, Hicks, *et al* found that only 13% of military, 22% of community based, and 11% of university trained residents felt comfortable doing knee arthrocentesis at this level⁴. This discomfort persists beyond training among many physicians in practice. Primary care physicians in Canada rate their confidence for joint procedures substantially lower than other MSK skills⁵.

In order to address this educational need, in 1994 the University of Washington designed an arthrocentesis and soft-tissue injection course designed for resident physicians with the primary focus of completing level R1 in internal medicine. The course consists of a half-day workshop that starts with an 80 minute didactic session on necessary equipment, techniques, and indications and contraindications for aspiration and injection of joints and soft tissues, followed by a 30-45 minute lesson in surface anatomy, during which resi-

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dents practice locating anatomic landmarks in order to perform the procedures taught during the course on one another under faculty guidance. Joint and soft-tissue areas included in the procedures are listed in Table 1. The rest of the day consists of a 120 minute practicum in the anatomy laboratory, where residents are supervised in intraarticular and paraarticular needle placement techniques using cadaver simulation.

An important aspect of any educational intervention is its durability. Studies have shown improvement following an arthrocentesis workshop; participants' scores in procedure comfort were maintained for 6 to 10 months^{6,7}.

The goal of our study was to conduct a survey, following completion of residency training, to assess the comfort level and current clinical application of MSK procedures for up to 5 years. Residents who were unavailable for the R1 course due to call schedule, vacation, etc., served as a control group.

MATERIALS AND METHODS

Surveys were mailed to graduates of the University of Washington Internal Medicine Residency Training program who had completed training in the years 2002 through 2006 and were practicing either in outpatient primary care (OPC) or hospital medicine (HM). The surveys collected data on the individual's current practice location and whether or not they participated in the arthrocentesis and soft-tissue injection course offered to all residents at the medicine R1 level. They were asked to quantify their experience using a Likert scale: how comfortable they felt doing arthrocentesis or injection on 13 different sites (1 = not at all comfortable, 5 = very comfortable); how important they felt residency instruction in each of the procedures to be (1 = not important, 3 = very important); how many times they had performed each procedure within the last year; and how many times they had referred a MSK procedure to a specialist. If there was no response to an initial mailing, a second questionnaire was sent.

Statistical analysis included t test and chi-square/Fisher exact analyses where appropriate.

RESULTS

We identified 84 internal medicine resident graduates from

Table 1. Total number of procedures performed per year by site of practice.

Site	Total (52)	Outpatient Primary Care (32)	Hospital Medicine (20)
Knee joint	348	318	30
Subacromial bursa	293	290	3
Trochanteric bursa	229	228	1
Common extensor tendon at the lateral epicondyle	62	61	1
Olecranon bursa	43	43	0
Trigger finger	38	38	0
First MTP joint	23	22	1
APL/EPB tendon sheath	20	19	1
AC joint	17	14	3
Elbow joint	8	8	0
Wrist joint	8	7	1
Ankle joint	8	5	3
Total	1097	1053	44

MTP: metatarsal phalangeal; APL: abductor pollicis longus; EPB: extensor pollicis brevis; AC: acromioclavicular.

2002–2006 as practicing either in OPC or HM. Of the 84 surveys mailed up to twice, we received 54 responses (66% response rate), 2 of which were disqualified as the respondents had subsequently transferred to subspecialty training. Thirty-two respondents were OPC (with or without some inpatient care activity) while 20 respondents practiced exclusively HM. Nine of the OPC graduates (28%) were trained in a traditional internal medicine track and 23 (72%) had trained in one of 2 primary care tracks offered at our institution. Of the HM graduates, 9 of 20 (45%) had been in the traditional track while 11 (55%) were primary care track graduates. Seventeen of the OPC graduates reported participating in the R1 course while 15 did not participate for various reasons. Of the HM graduates, 8 of 20 participated in the R1 course.

OPC graduates reported performing 1053 procedures at 12 different joint/soft tissue sites in the previous year (33 procedures per OPC clinician per year). HM graduates performed 44 procedures at 9 joint/soft tissue sites (2.2 per HM clinician per year). Overall, the most common procedures reported were knee joint arthrocentesis, followed by subacromial bursa injection, and trochanteric bursa injection. These 3 comprise more than 75% of all procedures performed by all respondents within the previous year (Table 1). No practitioner performed arthrocentesis or injection of a small joint of the fingers in the preceding year.

OPC graduates performed almost 15 times more MSK procedures than their HM counterparts and were also more comfortable doing them. HM physicians had an average comfort level with knee joint arthrocentesis of 3.01 (1 = not at all comfortable, 5 = very comfortable), and performed an average of 1.5 procedures per year, as compared to an average comfort level of 4.28 for those practicing OPC, who performed an average of 9.9 knee joint arthrocenteses per year ($p < 0.05$ for both). HM physicians as a group reported a level of comfort on 5-point Likert scale of 2 or higher at only 2 out of 13 sites (olecranon bursa 2.05 and knee joint 3.10). In contrast, OPC physicians reported a level of comfort of 2 or higher on the same scale at 6 joint/soft tissue sites (subacromial bursa 3.63, olecranon bursa 3.09, common extensor tendon at the lateral epicondyle 2.47, trochanteric bursa 4.25, knee joint 4.28, 1st metatarsophalangeal 2.09). Five of the 32 OPC graduates (15%) reported that they did not perform any MSK procedures in the preceding year while 9/20 HM physicians (45%) had not performed any procedures.

The survey asked graduates which sites they felt were important to be taught in training, assuming this would elicit sites they needed to know in practice. Several procedures were felt to be more important for those practicing OPC versus those practicing HM: injection of the trochanteric bursa, subacromial bursa, common extensor tendon at the lateral epicondyle, finger flexor tendons (trigger finger), and surprisingly, the acromioclavicular joint (Table 2). The teaching of acromioclavicular joint injection was felt by the OPC graduates to be more important than teaching procedures at the

Table 2. Importance of procedure instruction divided by respondent's practice setting. Values are on a scale of 1-3, where 1 = not important, 2 = important, 3 = very important.

	Outpatient Primary Care	Hospital Medicine	p
Knee joint	2.91	2.65	NS
Trochanteric bursa	2.87	2.35	0.0014
Subacromial bursa	2.75	2.10	0.0007
First MTP joint	2.39	2.45	NS
Olecranon bursa	2.48	2.10	NS
Common extensor tendon at the lateral epicondyle	2.52	1.95	0.002
Trigger finger	2.45	1.95	0.03
Ankle joint	2.23	2.25	NS
APL/EPB tendon sheath	2.26	1.95	
AC joint	2.28	1.80	0.01
Elbow joint	2.00	1.95	NS
Wrist joint	2.03	1.85	NS
Small joints of fingers	1.90	1.60	NS

AC: acromioclavicular; NS: not significant; for other definitions see Table 1.

wrist joint, elbow joint, or even ankle joint. Only 7 of 32 OPC physicians reported that they had injected an acromioclavicular joint in the preceding year and its position on the teaching importance list suggests that this may be a procedure that OPC referred to a specialist although this was not specifically asked in the survey.

The efficacy of the arthrocentesis and soft-tissue injection course was assessed by measuring the practitioner's comfort level with procedures and comparing those who participated in the R1 course with those who did not. For those in HM who took the R1 course, no difference was seen, versus nonparticipants, in the comfort level for any of the procedures. On the other hand, the OPC graduates who took the course reported performing almost twice the number of procedures/year versus OPC respondents who did not [mean number of procedures 41.4/year vs 23.5/year ($p = 0.04$)]. Not only were total numbers higher for course participants, the percentage of course participants performing more than 40 procedures per year was 35% compared to 13% for nonparticipants, although this did not reach statistical significance ($p = 0.07$). With regard to comfort level with procedures, the OPC R1 course participants were more comfortable in 8 of the 13 sites than nonparticipants and had similar comfort at the other 5 sites ($p = 0.0009$). In addition, OPC R1 course participants were significantly less likely to refer a procedure to another clinician ($p = 0.039$; Table 3). There was no significant difference for procedure referral for HM physicians by course participation although a distribution trend similar to the OPC results was present (Table 4).

The questionnaire also had space for comments from the respondents. The major themes of the comments included: (1) desire for additional training, often centered around specific joints; (2) request for postgraduate arthrocentesis and soft-tissue injection training; and (3) suggestion that the training pro-

Table 3. Number of procedures referred out within the previous year by outpatient primary care providers (OPC) by participation in R1 course.

	Participation	No Participation
Never	1	0
1-5	11	5
6-10	5	5
> 10	0	5

By Fisher exact analysis, OPC R1 course participants were significantly less likely to refer a procedure to another clinician ($p = 0.039$).

Table 4. Number of procedures referred out within the previous year by hospital medicine providers (HM) by participation in R1 course.

	Participation	No Participation
Never	2	0
1-5	5	9
6-10	1	2
> 10	0	1

By Fisher exact analysis; $p =$ nonsignificant.

gram provide opportunities for those going into primary care to do a MSK month during residency.

DISCUSSION

As the shortage of rheumatologists progresses, the need for the primary care physician to have both confidence and skill in the arena of MSK disorders increases. Prior authors noted deficiency in hands-on arthrocentesis training during residency, and successfully implemented arthrocentesis workshops on models/mannequins, with improvement in resident skill and confidence with MSK procedures^{6,8}. The use of cadavers has also been examined for teaching a wide range of procedural skills from thoracotomy and central venous catheter placement to arthrocentesis, with positive results^{7,9,10,11}.

In 2002 we published in abstract form results over 8 years of an arthrocentesis and soft-tissue injection course focused on medicine R1 and utilizing the anatomy laboratory for procedure simulation as described above⁷. The results indicated that only 16% of 224 residents who participated in the arthrocentesis and soft-tissue injection course between 1996 and 2002 felt comfortable performing MSK procedures prior to the activity. As a result of the course, 82% reported being more likely to perform procedures in the future, and this increase in comfort persisted up to 6 months, as 56% of 84 resident respondents stated they still felt comfortable with MSK procedures. Another important finding of the survey was that while participants felt more comfortable with doing the procedures as a result of the course, most medicine resident respondents did not feel that they had sufficient opportunities to perform the procedures in residency.

Based on the 2002 survey⁷ and our present assessment, it appears that a single half-day arthrocentesis and soft-tissue

injection course has a significant influence on the confidence with and performance of MSK procedures by internists practicing in the outpatient setting. The lack of effect of the course on HM graduates suggests that comfort with procedures may be lost over time if not utilized on a regular basis in practice.

Our study takes a unique approach of evaluating current clinical MSK procedure activity and confidence levels of individuals who underwent an educational intervention up to 7 years prior to survey completion. The level of durability of a MSK educational intervention has not previously been reported. We feel that the assessment of clinical practice patterns is a powerful tool for guiding curriculum development within training programs.

The limitations of our study include the relatively small sample size, subjectivity of reporting on numbers of procedures performed, and the numbers of times a procedure was referred to a specialist within the preceding year. In addition, the numbers of procedures performed by OPC physicians who participated in the course was significantly different, but the distribution by number of procedures was not, suggesting either that the number of respondents in each category was too small, or that due to some OPC participants reporting high numbers of procedures, results may have been skewed. There may be other variables that might explain the impressive and consistent procedure number difference between the OPC R1 course participants and nonparticipants and this is worthy of future exploration.

Based upon these findings, we make the following recommendations for resident MSK procedure education: All medicine interns should receive training in aspiration and/or injection of the knee joint, subacromial bursa, and trochanteric bursa, as these comprise the vast majority of all injections performed in clinical practice. Once an internal medicine resident clearly identifies a primary care career path (likely not until the second or third year of internal medicine training), we recommend a more extensive training course in arthrocentesis and soft-tissue injection, along with participation in MSK rotation designed to maximize opportunities to perform procedures under supervision. This should be based on career plans and not on training track (traditional vs primary care).

Finally, training programs should consider developing MSK procedure continuing education courses using supervised simulation, where graduates can have opportunities to refresh their skills and practice injecting or aspirating sites that the clinician has identified as a practice need.

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