

Do family physicians request ultrasound scans appropriately?

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Abstract

Objective To review family physicians' requests for abdominal, thyroid, pelvic, soft tissue, and carotid ultrasound (US) scans, and to determine whether 5% or more of these tests were not clearly indicated based on the clinical history provided.

Design Analysis of 620 randomly chosen requests for US scans.

Setting The Radiology Department at the Capital District Health Authority in Halifax, NS, between October 1, 2008, and June 30, 2009.

Participants Two radiologists and 2 family physicians with clinical expertise and familiarity with the Canadian Association of Radiologists' 2005 guidelines.

Main outcome measures Whether US requests were "indicated," "not clearly indicated," or "not legible" according to the Canadian Association of Radiologists' 2005 guidelines. Those that were illegible were discarded and replaced.

Results More than 5% of requests for abdominal, thyroid, or carotid US scans were not clearly indicated. The percentages of requests for pelvic and soft tissue scans that were not clearly indicated were not significant. The reviewers found only 5 illegible request forms. Percentages of abdominal, thyroid, and carotid US scans not clearly indicated were 12.1%, 18.8%, and 25.2%, respectively. Reasons for inappropriate US requests included the following: wrong tests (3.2%), vague clinical questions (4.8%), and unfocused examinations (4.8%) for abdominal scans; wrong tests (3.2%), vague clinical questions (3.2%), unnecessary investigations (5.6%), and unnecessary follow-up examinations (5.6%) for thyroid scans; and unnecessary tests (10.5%), vague clinical questions (5.6%), and unnecessary tests for "dizziness" (10.5%) for carotid scans.

Conclusion More than 5% of the abdominal, thyroid, and carotid US scans requested by family physicians were not clearly indicated based on the clinical history provided. Common trends in requesting these examinations reinforce the need to improve guidelines for requesting scans and for managing many presenting complaints in family practice.

EDITOR'S KEY POINTS

- The goal of this study was to determine whether family physicians were requesting abdominal, pelvic, thyroid, soft tissue, and carotid ultrasound (US) scans appropriately, as well as to establish trends in scans that were not clearly indicated.
- The results of this study show that a significant proportion of abdominal, thyroid, and carotid US scans requested by family physicians were not clearly indicated ($P < .001$). The most common reasons related to not clearly indicated requests for US investigations included vague clinical questions, ordering the wrong tests, unnecessary follow-up examinations, and ordering unnecessary tests.
- To help guide decisions about imaging investigations and to ensure that patients receive the most appropriate tests, family physicians should provide a synopsis of the presenting complaint and a clear clinical query when they request US examinations. Focused requests can reduce the time needed to perform scans and allow more patients to be scanned in a day, which could reduce wait times.

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Les médecins de famille prescrivent-ils les échographies de façon appropriée?

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Résumé

Objectif Vérifier les prescriptions d'échographie de l'abdomen, de la thyroïde, du bassin, des tissus mous et des carotides prescrites par des médecins de famille et déterminer si 5% ou plus de ces examens n'avaient pas d'indication claire compte tenu de l'histoire clinique fournie dans la demande.

Type d'étude Analyse de 620 demandes d'échographie choisies au hasard.

Contexte Le département de radiologie du Capital District Health Authority d'Halifax, N-É, entre le premier octobre 2008 et le 30 juin 2009.

Participants Deux radiologistes et 2 médecins de famille qui avaient une bonne connaissance clinique des directives de 2005 de l'Association canadienne des radiologistes.

Principaux paramètres à l'étude Déterminer si les demandes d'échographies étaient « indiquées », « non clairement indiquées » ou « illisibles » d'après les directives de 2005 de l'association canadienne des radiologistes. Les demandes illisibles ont été rejetées et remplacées.

Résultats Plus de 5% des prescriptions d'échographie de l'abdomen, de la thyroïde ou des carotides n'avaient pas d'indication claire. Le pourcentage des demandes d'échographie du bassin et des tissus mous qui n'avaient pas d'indication claire n'était pas significatif. Les réviseurs n'ont trouvé que 5 formulaires de demande illisibles. Le pourcentage des demandes d'échographie sans indication claire était de 12,1% pour l'abdomen, 18,8% pour la thyroïde et 25,2% pour les carotides. Les raisons pour lesquelles les demandes d'échographie étaient inappropriées incluaient : mauvais choix d'examen (3,2%), question clinique vague (4,8%) et examen imprécis (4,8%) pour les échographies de l'abdomen; mauvais choix d'examen (3,2%), question clinique vague (3,2%), examen inutile (5,6%) et examen de suivi non nécessaire (5,6%) pour les échographies de la thyroïde; et examen inutile (10,5%), question clinique vague (5,6%) et examen pour « étourdissements » inutile (10,5% pour les échographies des carotides.

Conclusion Plus de 5% des échographie de l'abdomen, de la thyroïde et des carotides prescrites par des médecins de famille n'avaient pas d'indication claire compte tenu de l'histoire clinique fournie. De telles tendances fréquemment observées dans la façon de prescrire ces examens laissent croire qu'il y a lieu d'améliorer les directives concernant la prescription d'échographies et la prise en charge de plusieurs symptômes rencontrés en pratique familiale.

POINTS DE REPÈRE DU RÉDACTEUR

- Cette étude avait pour but de déterminer si les médecins de famille prescrivent les échographies de l'abdomen, du bassin, de la thyroïde, des tissus mous et des carotides de façon appropriée, mais aussi de déceler certaines tendances à demander ces examens sans indication claire.
- Les résultats de cette étude montrent que pour une proportion importante des échographies de l'abdomen, de la thyroïde et des carotides prescrites par des médecins de famille, il n'y avait pas d'indication claire ($P < .001$). Les raisons les plus fréquentes des prescriptions d'échographie sans indications claires incluaient des questions cliniques imprécises, le fait de prescrire le mauvais examen, un examen de suivi non requis ou des examens inutiles.
- Pour faciliter le choix des examens d'imagerie et s'assurer que les patients reçoivent les examens les plus appropriés, les médecins de famille devraient fournir un résumé des principaux symptômes dont se plaint le patient et formuler une question claire lorsqu'ils prescrivent des ÉCHO. Des demandes d'examen bien formulées peuvent réduire le temps requis pour effectuer l'examen et permettre d'examiner plus de patients par jour, ce qui pourrait diminuer le temps d'attente.

Cet article a fait l'objet d'une révision par des pairs.
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Since the 1990s, both the availability and demand for diagnostic imaging have increased.¹ Imaging is one of the fastest growing areas of medicine in the United States, with costs estimated at approximately \$100 billion annually.² As a result, research in recent years has focused on ways to ensure appropriate use and efficient delivery of imaging services.

The Royal College of Radiologists first released guidelines for radiologic referral in 1990, and several studies have demonstrated that use of these guidelines can lead to substantial reductions in the number of inappropriate requests for imaging scans^{1,3-8}; however, physicians rarely use the guidelines. Recent survey results showed that only approximately 2% of specialist physicians and residents listed the American College of Radiology's Appropriateness Criteria in their top 3 choices for guidance when ordering imaging scans; interestingly, Google was a top choice for nearly one-third of respondents.²

Results of retrospective studies suggest that the proportion of inappropriate requests is higher for ultrasound (US) scans than for other imaging modalities.⁹⁻¹¹ In a random sample of requests for US scans, Van Breuseghem and Geusens demonstrated that approximately 55% of requests did not conform to the guidelines; this is compared with 40% of requests for computed tomography and 11% of requests for magnetic resonance imaging.¹¹ Sardanelli et al demonstrated that 76% of requests for US scans were not clearly justified; most lacked information or a clear clinical query, but only 9% had an "absence of real indication." This was compared with 77% of requests for computed tomography scans of the body and 83% of requests for magnetic resonance imaging of the musculoskeletal system.²

We undertook this study to assess whether family physicians in Halifax, NS, were requesting abdominal, pelvic, thyroid, soft tissue, and carotid US scans appropriately. We tested the hypothesis that 5% or more of these requested scans were not clearly indicated. Secondary objectives were to assess the level of agreement among reviewers on the appropriateness of requests for scans of each body system and to establish trends in requests for scans that were not clearly indicated.

METHODS

We retrospectively reviewed 620 US request forms submitted to the Diagnostic Imaging Department at the Capital District Health Authority in Halifax between October 1, 2008, and June 30, 2009. We obtained the forms from the Picture Archiving and Communications System (PACS – AGFA IMPAX). Forms were included if they bore requests from family physicians in our centre for US examinations of any of the 5 body systems. Illegible request forms were excluded. Only written or

typed copies of the original request forms were retrieved; no images were retrieved. All examinations had been requested by family physicians from the catchment area of the Capital District Health Authority, a large referral hospital serving 400 000 people in Halifax.

A sample size of 124 for each type of scan was selected, as it would provide an 87% power to detect whether 5% or more scans were not clearly indicated, with a 5% type 1 error.

Two radiologists and 2 family physicians were each provided with a copy of the Canadian Association of Radiologists' 2005 guidelines and were asked to use the guidelines in combination with their clinical expertise to decide whether requested scans were "indicated," "not clearly indicated," or "not legible" based on information provided by referring physicians. Reviewers were also asked to comment on their findings.

Request forms distributed to reviewers were edited to remove all identifying information on patients (except sex and date of birth) and referring physicians. Consensus was defined as agreement among 3 of 4 reviewers with respect to whether a request was indicated, not clearly indicated, or not legible. When consensus was not reached, the 4 reviewers met and held a vote. In the case of a tie, an additional radiologist was called upon to vote. Request forms that were not legible were replaced with legible forms at adjudication sessions.

Identification of trends in reasons for requests for scans that were not clearly indicated was based on an analysis of reviewer comments.

For the primary analysis, we used the 1-sample proportion test to evaluate the null hypothesis for each body system. A *P* value of .05 or less was considered statistically significant. For the secondary analysis, we used the κ statistic to assess the level of agreement among reviewers. Cohen κ statistic for interrater agreement was computed for the pair of radiologists and for the pair of family physicians, and Fleiss κ statistic was computed for all 4 reviewers together. Bootstrap 95% bias-corrected, accelerated confidence intervals were computed for the κ statistics.

Ethics approval was obtained from the Capital District Health Authority Research Ethics Board.

RESULTS

For thyroid, abdominal, and carotid US scans, 18.8%, 12.1%, and 25.2% of requests, respectively, were for scans that were not clearly indicated. For pelvic and soft tissue scans, only 1.6% and 2.4%, respectively, were for scans that were not clearly indicated (**Table 1**).

The secondary analysis of κ statistics indicated that the 2 radiologists were in excellent agreement about the

Table 1. Percentage of requests for scans that were not clearly indicated

TYPE OF SCAN	PERCENTAGE OF REQUESTS FOR SCANS NOT CLEARLY INDICATED, %	95% CONFIDENCE INTERVAL	P VALUE
Thyroid	18.8	0.126–0.272	<.001
Pelvic	1.6	0.003–0.064	.135
Abdominal	12.1	0.070–0.199	<.001
Carotid	25.2	0.180–0.340	<.001
Soft tissue	2.4	0.006–0.074	.266

requests, while the 2 family physicians were in poor-to-moderate agreement. Overall agreement among all reviewers was poor to moderate (Table 2).

Reviewer comments helped to identify 2 common trends in inappropriate requests for thyroid, abdominal, and carotid scans. The first was ordering the wrong test for the clinical query, and the second was providing a vague clinical question (Table 3). For thyroid scans, ordering unnecessary tests for presenting problems and unnecessary follow-up of thyroid nodules were also identified. For abdominal and carotid scans, ordering too broad a test for the clinical problem was identified. Specifically for carotid scans, reviewers found a trend to inappropriate investigation of dizziness.

The reviewers found 5 illegible request forms, 2 for pelvic scans, 2 for soft tissue scans, and 1 for a carotid scan. These forms were all excluded from the analysis.

DISCUSSION

We found that more than 5% of family physicians' requests for thyroid, abdominal, and carotid US scans were not clearly indicated (Table 1). The proportion of such requests, however, was lower in our study than in previous studies.^{9,11–13}

In our study, 18.8% of the requests for thyroid US scans were not clearly indicated, but in a study by Liel and Fraenkel,⁹ 93% of requests for scans were not clearly indicated. That study, however, used the diagnostic outcome of an endocrine consultation to determine the appropriateness of the requests, and reviewers' decisions were based on a variety of textbooks and clinical practice guidelines on the acceptable indications for thyroid US scans.⁹ In a study by Sardanelli and colleagues,¹² 75% of requests for scans were identified as inappropriate, substantially higher than the 14% in our study, owing to a larger number of requests having no clear query or lacking patient information. The proportion of inappropriate requests for carotid scans was 25.2% in our study, higher than for any other body system and similar to the results of a study by Hill and colleagues¹⁴ who also found dizziness to be a common reason for inappropriate requests.

To the best of our knowledge, our study is the first to document that most family physicians' requests for soft tissue scans were for clinically appropriate indications. The low number of requests for inappropriate pelvic scans is in keeping with previous studies that

Table 2. Interrater agreement on requests for scans

TYPE OF SCAN	RADIOLOGISTS, κ (95% CI)	FAMILY PHYSICIANS, κ (95% CI)	ALL, κ (95% CI)
Thyroid	0.95 (0.84 to 1.00)	0.54 (0.30 to 0.76)	0.45 (0.30 to 0.60)
Pelvic	1.0 (NA*)	-0.014 (-0.05 to 0.00)	0.23 (0.00 to 0.57)
Abdominal	0.88 (0.38 to 1.00)	0.39 (0.21 to 0.59)	0.30 (0.19 to 0.46)
Carotid	0.96 (0.82 to 1.00)	0.33 (0.14 to 0.52)	0.40 (0.27 to 0.54)
Soft tissue	0.81 (0.43 to 0.95)	-0.022 (-0.06 to 0.00)	0.35 (0.19 to 0.52)

CI—confidence interval, NA—not applicable.

*The 95% bootstrap bias-corrected, accelerated CI is undefined when the observed κ statistic is 1.

Table 3. Common trends in inappropriate requests: A sample size of 124 requests for each type of scan was selected.

TYPE OF SCAN	COMMON TRENDS	N (%)
Thyroid	• Wrong test for the clinical query	4 (3.2)
	• Vague clinical question	4 (3.2)
	• Unnecessary test for the presenting problem	7 (5.6)
	• Unnecessary follow-up of benign thyroid nodules	7 (5.6)
Abdominal	• Wrong test for the clinical query	4 (3.2)
	• Vague clinical question	6 (4.8)
	• Too broad a test for the clinical problem	6 (4.8)
Carotid	• Unnecessary test for the presenting problem	13 (10.5)
	• Vague clinical question	7 (5.6)
	• Inappropriate investigation of "dizziness"	13 (10.5)

demonstrated that family physicians requested this examination appropriately.^{15,16} This could be because symptoms are more clearly defined (eg, bleeding) or because family physicians know more about this body system.

The κ statistics showed mild-to-low overall interrater agreement on requests for scans for all body systems (Table 2). Agreement between our 2 radiologist reviewers was high for all body systems. This likely reflects their similar knowledge and training. Agreement between our 2 family physician reviewers was moderate-to-nonexistent, depending on body system. For requests for pelvic and soft tissue scans, a negative κ was computed, indicating that agreement was less than by chance alone. However, negative κ does not necessarily reflect low overall rates of agreement in the case of rare findings because κ is affected by the prevalence of the finding under consideration.¹⁷ In our study, requests for pelvic and soft tissue scans that were not clearly indicated were a rare finding in the raw data.

The lower κ values for family physician reviewers could be explained in a couple of ways. First, family doctors are not experts in the area of indications for US scans, given that their training is centred on primary care. Second, as there is no consensus in the literature on the role of imaging in the management of many symptoms and conditions, poor interrater agreement would be expected.

Trends in requests

The secondary objective of this work was to identify trends in requests for scans that were not clearly indicated. Our results suggest that the reasons for inappropriate requests were most often related to vague clinical questions, ordering the wrong tests, unnecessary follow-up examinations, and ordering unnecessary tests.

Our reviewers found that forms for scan requests had vague clinical questions or were for unnecessary examinations when nonspecific histories, such as "mid-abdominal pain" or "dizzy," were provided. The differential diagnosis for such complaints is broad and is unlikely to be narrowed substantially by US scans. To help guide decisions about imaging investigations and to ensure that patients receive the most appropriate tests, family physicians should provide a synopsis of the presenting complaint and a clear clinical query when requesting US examinations.

One of the most common reasons for inappropriate requests for abdominal examinations was the physician requesting a full abdominal US when a more focused study would have answered the clinical question. This was attributed to physicians requesting investigations that were too broad when more specific US scans would have been sufficient. For example, when a family physician provides a history in a request for a scan of the abdominal aorta but labels the scan as an abdominal US

on the request form, his or her patient is automatically booked for the much lengthier full-abdominal examination. Focused requests can reduce the time needed to perform scans and allow more patients to have imaging examinations in a day, which could reduce wait times.

Inappropriate requests for thyroid scans were often related to follow-up of nonpalpable nodules that had been detected incidentally during various imaging investigations. These lesions, called *incidentalomas*, are typically smaller than 1 cm and have an estimated prevalence of 50% at autopsy when all age groups are considered.^{18,19} When incidental lesions are detected, US scans are recommended at 6 months and 12 months for lesions measuring between 5 mm and 10 mm with normal sonographic features. If no alarming changes are detected, further imaging is not warranted.^{18,20} This conservative approach is supported by limited recent evidence showing that nodules measuring less than 5 mm and containing papillary thyroid microcarcinoma (confirmed by fine-needle aspiration) rarely have the potential for metastasis and do not require follow-up or biopsy providing sonographic features are normal.^{18,21}

Our reviewers thought a substantial number of inappropriate requests for carotid scans were for the vague symptom of dizziness. Unfortunately, the Canadian Association of Radiologists' guidelines offer little guidance on investigating this complaint, but recent guidelines from the Multidisciplinary Practice Guidelines Committee of the American Society of Neuroimaging do not recommend imaging examination for this complaint.²² The American College of Radiology's 2009 *ACR Appropriateness Criteria* is available online and can be searched by symptoms, specific conditions, or more broadly, by body system.²³ Searching under *dizziness*, however, returns references exclusively to vertigo, and US examination is not included as an indicated test. When investigating dizziness, family physicians should consider many causes, such as disequilibrium and presyncopal and ill-defined light-headedness.²⁴

Limitations

There are several limitations to our work. By considering only family physicians' requests for US scans, we have gained just a partial understanding of the factors contributing to the inappropriate use of imaging investigations. Also, we did not consider requests from family physicians based in emergency departments. In addition, our work examined only requests in which imaging scans were actually carried out. This could lead to selection bias because cases in which scans were not clearly indicated and not carried out were not considered. Likewise, cases in which patients did not present for their scans because their symptoms resolved before their appointments were not considered.

Conclusion

The results of our study suggest that a significant proportion of family physicians' requests for abdominal, thyroid, and carotid US examinations in our centre were for scans that were not clearly indicated ($P < .001$). This raises problems in both cost and quality of patient care. Health care, like other industries, must address wasteful practices to ensure sustainability. Requests for imaging that is not clearly indicated contribute to lengthening wait times, which could adversely affect patient care by delaying diagnosis and treatment. Finally, US scans are considered one of the safest imaging modalities, and inappropriate requests for scans could cause unnecessary emotional distress.

Acknowledging the importance of this problem is a necessary first step. Radiologists must work closely with family physicians to establish practical, symptom-based guidelines for requesting US scans and other imaging modalities. Family physicians often understand the needs of their patients better than any other health care providers. Maintaining direct access to imaging services is, therefore, essential in ensuring that family physicians can provide the best level of care to their patients. 

Dr Landry was a medical student at the time of this study and is now a resident in Diagnostic Radiology at McMaster University in Hamilton, Ont. **Dr Barnes** is Head of the Department of Diagnostic Radiology, **Dr Keough** is a radiologist in the Department of Diagnostic Radiology, **Dr Watson** is a family physician in the Department of Family Medicine, **Dr Rowe** is a radiologist in the Department of Diagnostic Radiology, **Dr Mallory** is a family physician in the Department of Family Medicine, and **Mr Abdolell** is a statistician in the Department of Diagnostic Radiology, all at Dalhousie University in Halifax, NS.

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Contributors

Dr Landry contributed to concept, proposal, design, and implementation of the study; data analysis; and manuscript preparation. **Dr Barnes** contributed to concept, proposal, and design of the study; and manuscript preparation. **Dr Keough**, **Dr Watson**, **Dr Rowe**, and **Dr Mallory** contributed to design and implementation of the study. **Mr Abdolell** contributed to design of the study and data analysis. All the authors approved the final manuscript for publication.

Competing interests

None declared

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