

The role of routine groin ultrasonography in the management of inguinal hernia

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Background: Groin ultrasonography (US) has been used as an adjunct to inguinal hernia diagnosis, but there is limited evidence as to whether its use affects surgical decision-making. The primary aim of this study was to examine whether groin US affects surgical management of inguinal hernia; the secondary goal was to estimate the frequency of groin US ordered before surgical consultation.

Methods: We performed a retrospective chart review of 400 consecutive patients aged older than 18 years referred to 1 of 4 general surgeons in Calgary, Alberta, for inguinal hernia between January 2014 and January 2015. Bilateral groin examinations were entered as separate entries into the database. Outcomes assessed included the frequency of groin US examinations performed within 1 year before the general surgery consultation, presence of inguinal hernia on clinical examination (CE), presence of inguinal hernia on groin US, and whether the hernia proceeded to herniorrhaphy.

Results: A total of 476 groins in the 400 patients (354 [88.5%] male; mean age 53.5 yr [standard deviation 15.2 yr]) were evaluated for a hernia during the study period. Groin US was performed before general surgery consultation in 336 cases (70.6%). Overall, 364 (76.5%) of the hernias were clinically palpable; of the 364, 220 (60.4%) had preconsultation US, even in the presence of a positive CE finding. Of the 112 groins that did not have a clinically palpable hernia, 103 (92.0%) underwent preconsultation US. Of the 476 groins, 315 (66.2%) underwent inguinal hernia repair: 310 (85.2%) of the 364 with clinically palpable hernias and 5 (4.8%) of the 103 with clinically negative findings but positive groin US findings. Surgical decision-making based on CE findings occurred in 390 cases (81.9%) overall, whereas surgery based on groin US findings alone occurred in 5 of 336 cases (1.5%).

Conclusion: Routine groin US was frequently performed before general surgery consultation, whether a hernia was detectable on clinical examination or not. Positive groin US results alone infrequently affected whether the patient proceeded to surgery. Clinical examination findings played a larger role in surgical decision-making than groin US results. Eliminating the practice of routine groin US may provide considerable health care cost savings.

Contexte : L'échographie de l'aîne est utilisée comme complément pour diagnostiquer la hernie inguinale, mais on ne sait pas si son utilisation influence la prise de décisions chirurgicales. L'objectif principal de cette étude était de déterminer si l'échographie a une incidence sur la prise en charge chirurgicale de la hernie inguinale; l'objectif secondaire était d'estimer la fréquence de prescription d'une échographie de l'aîne avant la consultation en chirurgie.

Méthodes : Nous avons procédé à un examen rétrospectif des dossiers de 400 patients consécutifs âgés de plus de 18 ans ayant été envoyés pour une hernie inguinale à 1 des 4 chirurgiens généralistes de Calgary (Alberta) entre janvier 2014 et janvier 2015. Lorsque des examens bilatéraux de l'aîne étaient réalisés, les résultats étaient entrés séparément dans la base de données. Les paramètres évalués comprenaient le nombre d'échographies de l'aîne réalisées dans l'année précédant la consultation en chirurgie générale, la présence d'une hernie inguinale lors de l'examen clinique, la présence d'une hernie inguinale lors de l'échographie de l'aîne et la complication ou non de la hernie en herniorrhaphie.

Résultats : Un total de 476 aînes chez les 400 patients (354 [88,5 %] hommes; âge moyen 53,5 ans [écart type 15,2 ans]) ont été examinées pour une hernie durant la période à l'étude. Une échographie de l'aîne a été réalisée avant la consultation en chirurgie générale pour 336 cas (70,6 %). Au total, 364 (76,5 %) hernies étaient palpables à l'examen clinique, dont 220 (60,4 %) ont fait l'objet d'une échographie de

l'aine avant la consultation, même lorsqu'il y avait déjà eu détection à l'examen clinique. Des 112 aines qui ne présentaient pas de hernie palpable à l'examen clinique, 103 (92,0 %) ont fait l'objet d'une échographie de l'aine avant la consultation. Des 476 aines, 315 (66,2 %) ont fait l'objet d'une réparation de hernie inguinale, soit 310 (85,2 %) des 364 hernies palpables à l'examen clinique et 5 (4,8 %) des 103 hernies détectées uniquement à l'échographie. La décision d'opérer ou non a été prise d'après les résultats de l'examen clinique dans 390 des cas (81,9 %), et d'après les résultats de l'échographie de l'aine uniquement dans 5 des 336 cas (1,5 %) seulement.

Conclusion : L'échographie de l'aine est fréquemment réalisée de routine avant la consultation en chirurgie générale, qu'une hernie soit détectable ou non à l'examen clinique. La détection d'une hernie uniquement à l'échographie a influencé la décision de traiter le patient par intervention chirurgicale dans de rares cas. Les résultats obtenus à l'examen clinique ont un plus grand rôle que ceux de l'échographie de l'aine dans la prise de décisions chirurgicales. Éliminer l'échographie de l'aine réalisée de routine pourrait donc réduire substantiellement les coûts des soins de santé.

Inguinal hernias are a common condition seen in primary care.¹ The lifetime occurrence of inguinal and femoral groin hernias is 27%–43% in men and 3%–6% in women. More than 20 million patients around the globe undergo inguinal hernia repair annually.² Inguinal hernias are almost always eventually symptomatic. A 2013 randomized controlled trial showed that almost 70% of asymptomatic patients with inguinal hernias eventually underwent herniorrhaphy over a median of 5 years of follow-up.³

Historically, the gold standard for inguinal hernia diagnosis has been clinical examination (CE) of the groin, with a sensitivity of 0.745 and a specificity of 0.963.⁴ Groin ultrasonography (US) has been described in multiple studies as a useful diagnostic tool for the diagnosis of groin hernias, specifically in the context of femoral hernias or symptomatic occult hernias (undetected by physical examination alone).^{5–8} Groin US is highly sensitive⁹ and well tolerated by patients, while also avoiding deleterious effects of ionizing radiation. A recent systematic review showed that US had higher sensitivity and specificity than magnetic resonance imaging and computed tomography when the operator's level of expertise was adequate.¹⁰

For years, the routine use of groin US performed before a general surgery consultation has been debated in the literature.¹¹ Although groin US has a higher sensitivity in detecting inguinal hernias than CE, there is evidence that the clinical findings have a greater influence on the decision to treat surgically.⁴ The evidence for the effectiveness of groin US in diagnosing occult inguinal hernias is mixed, with a wide range of sensitivities and specificities being reported,^{12,13} and it has been described as an unreliable method to completely exclude an occult hernia.¹⁴ Consequently, magnetic resonance imaging is recommended as a definitive radiologic examination in these cases.¹⁵

It is unclear whether routine groin US aids significantly in the management of inguinal hernia. The international guidelines for groin hernia management¹⁶ state:

History and clinical examination are usually all that are required to confirm the diagnosis of a clinically evident groin hernia. ... An apparent hernia with clear clinical features such as a reducible groin bulge with local discomfort usually requires no further investigation.

Regardless of the presence of a clinically palpable hernia, groin US is frequently ordered before a general surgery consultation. The associated cost of performing groin US and interpreting the findings is significant. Therefore, given the uncertain utility of routine groin US in the evaluation and management of inguinal hernias, this imaging modality may be a large and unnecessary burden to the health care system.

The aim of this study was to examine the frequency of routine groin US performed before a general surgery consultation and whether it affected surgical decision-making. This was a quality-improvement initiative to save health care expense based on evidence.

METHODS

We used a chart review of 400 consecutive patients aged older than 18 years referred to 4 general surgeons (P.M., E.D., A.R., N.C.) in Calgary, Alberta, between January 2014 and January 2015 for groin hernia(s) to create a database for a retrospective data analysis. The CE was performed by 1 of the 4 general surgeons. We defined a positive finding on CE as a palpable groin lump with or without cough impulse. We reviewed the groin US reports retrospectively to determine whether an inguinal hernia was detected on preconsultation imaging. Bilateral groin examinations were entered as separate entries into the database.

The database included the frequency of groin US examinations performed within 1 year before the general surgery consultation, presence of inguinal hernia on CE, presence of inguinal hernia on groin US, and whether the hernia proceeded to herniorrhaphy. We documented pertinent patient baseline characteristics, including body mass

Table 1. Gender and age of patients referred for groin hernia(s) between January 2014 and January 2015

Characteristic	Surgeon 1 n = 100	Surgeon 2 n = 100	Surgeon 3 n = 100	Surgeon 4 n = 100	Overall n = 400
Gender, no. (%)					
Male	86 (86.0)	91 (91.0)	85 (85.0)	92 (92.0)	354 (88.5)
Female	14 (14.0)	9 (9.0)	15 (15.0)	8 (8.0)	46 (11.5)
Age, mean ± SD, yr	56.0 ± 16.7	55.1 ± 16.8	53.0 ± 13.2	50.0 ± 13.9	53.5 ± 15.2
SD = standard deviation.					

index, history of chronic obstructive pulmonary disease or other comorbidities, smoking status and previous surgery, obtained from electronic medical records.

Statistical analysis

We defined groin US as significant in affecting surgical decision-making when it showed the presence of a hernia in the absence of a clinically palpable hernia, leading to herniorrhaphy (US+/CE-/S+). We classified a CE as significant in affecting surgical decision-making when the findings were positive and the patient underwent surgery (CE+/S+). We used descriptive statistics to compare the relative influence of groin US and CE on surgical management in 2 ways: to compare the rate at which hernias were operated on when detected by groin US or CE (US+/S+ or CE+/S+); and to compare the frequency of significant groin US and CE leading to operative management of inguinal hernias.

RESULTS

Among the 400 patients included in the study, 476 groins were evaluated for a hernia. The mean age of the patients was 53.5 (standard deviation 15.2 [range 19–93]) years, and the male to female ratio was 7.7:1.0 (Table 1). Groin US was performed before general surgery consultation in 336 cases (70.6%). A total of 364 inguinal hernias (76.5%) were detected clinically by palpation. Of the 364, 220 (60.4%) had preconsultation US, even in the presence of a positive CE finding. Of the 112 groins (23.5%) that did not have a clinically palpable hernia, 103 (92.0%) underwent preconsultation groin US.

A total of 315 groins (66.2%) underwent inguinal hernia repair. Of the 364 hernias detected on CE, 310 (85.2%) were repaired surgically (CE+/S+). In comparison, an inguinal hernia was detected in 310 (92.3%) of the 336 groins evaluated by groin US, of which 202 (65.2%) proceeded to surgery. The CE findings were considered significant and led to a decision to treat surgically in 390 (81.9%) of the 476 groins. Groin US was considered to have affected surgical decision-making in 5 (4.8%) of 103 cases. There were no instances in which patients with nonpalpable groin hernias and negative groin US findings underwent surgery.

Table 2. Influence of clinical examination and groin ultrasonography findings on surgical decision-making

Scenario	No. (%) of groins n = 476
Underwent inguinal hernia repair (S+)	315 (66.2)
Clinically detectable hernia leading to surgery (CE+, S+) (n = 364)	310 (85.2)
Hernia detected by routine US leading to surgery (independent of CE findings) (CE+/-, US+, S+) (n = 310)	202 (65.2)
Clinical examination significantly affected decision to treat surgically (CE +/-, S+/-)	390 (81.9)
Positive US findings leading to surgery in absence of positive CE findings (CE-, US+, S+) (n = 103)	5 (4.8)
Routine US significantly affected decision to treat surgically (US+, S+) (n = 336)	5 (1.5)
CE = clinical examination; S = surgery; US = ultrasonography.	

Overall, the decision to perform surgery based on CE findings was made in 390 cases (81.9%) (Table 2). In comparison, the decision to proceed with surgery based on groin US findings alone was made in 5 (1.5%) of 336 cases.

Five patients (1.2%) had significant groin US but negative CE findings (US+/CE-/S+) and proceeded to surgery. Three of the 5 were female, 2 had a very small indirect inguinal hernia, 2 had no inguinal hernia at the time of surgery, and 1 underwent diagnostic laparoscopy, which showed no inguinal hernia. Age, body mass index and comorbidities of the 5 patients were not statistically significantly similar.

DISCUSSION

We found that groin US was ordered by the referring family physician to evaluate for an inguinal hernia within 1 year before the general surgery consultation in 70.6% of cases.

To our knowledge, only 1 prior study investigated the frequency with which groin US is ordered before general surgery evaluation. Chmiel and colleagues¹⁷ conducted a Choosing Wisely Australia audit and found that preconsultation groin US was performed in 70% of 186 patients referred to general surgeons for inguinal hernia repair. Only 25% of the US examinations had a documented indication such as an occult hernia. Those authors recommended that routine preoperative investigations should be avoided; rather, preoperative investigations should be

ordered in response to the patient's factors, signs, disease type and surgery planning. They also recommended that routine groin US should not be ordered for clinically apparent inguinal hernias. In our study, we noted a high proportion of groins investigated with groin US. Our study also showed that 60.4% of hernias that were palpable on CE had preconsultation US. The international guidelines for groin hernia management propose that groin US should be reserved for specific situations such as occult inguinal hernias.¹⁶ Our findings thus indicate that groin US was overused in the primary care setting for investigation of inguinal hernia.

In our sample, an inguinal hernia was detected in 92.3% of groins examined with US. In a UK study, Depasquale and colleagues⁶ performed an audit of all groin US examinations performed between January 2000 and June 2004, and reported a rate of detection of inguinal hernias of 41.2%. The difference in positive US findings between our study and that audit indicates that most patients with negative findings on groin US are not referred to general surgeons for a clinical evaluation. We also observed that only 65.2% of groins with positive findings on groin US underwent surgery. This is in keeping with a study by Kim and colleagues,¹ who found that 56.5% (87/154) of groins in which a hernia was detected on US had surgery. Groins with a clinically palpable hernia were more likely to proceed to surgery (85.2% in our study and 66.7% in that by Kim and colleagues¹). We found that positive findings on groin US ordered routinely before a general surgery consultation did not significantly affect the decision to proceed with surgery. Our data suggest that general surgeons preferentially rely on CE findings for most clinical encounters. Overall, our findings are in keeping with those of Kim and colleagues,¹ who suggested that CE has a greater influence on surgical decision-making than groin US.

We compared the frequency of significant groin US (US+/CE-/S+) and significant CE (CE+/S+) and found that only 5 (1.5%) of the 336 routine groin US examinations ordered affected surgical decision-making. These 5 US examinations led to surgery in the context of a clinically occult hernia, which was evaluated with groin US in 103 cases (5/103 = 4.8%). This is considering that all patients seen by a surgeon are examined clinically. An inguinal hernia was found during the operation in only 2 of the 5 patients. We found no patient characteristic that was significantly correlated with having significant groin US. Previous studies indicated that patients with obesity who have had prior surgery may benefit from groin US.^{4,5} Our findings do not permit the formulation of recommendations as to which patients should undergo surgery when they have negative findings on CE and positive findings on groin US, as our sample was too small, and defining these criteria was not part of our calculations and intent when designing the study.

We did not identify any studies examining the satisfaction rates of patients who had surgical repair for occult hernias detected on groin US. Several authors recommend surgical repair of a contralateral occult inguinal hernia found incidentally during laparoscopic (transabdominal preperitoneal or totally extraperitoneal) inguinal hernia repair;¹⁸⁻²⁰ however, this is still a controversial topic. Kara and colleagues²¹ advocate for routine preoperative contralateral groin US to detect a contralateral occult inguinal hernia when an inguinal hernia is present. In cases in which the contralateral US examination gives positive findings, they proceed with a laparoscopic totally extraperitoneal repair to fix the 2 sides concurrently.

To our knowledge, no prior investigators have estimated the cost of routine groin US for evaluating inguinal hernias. In Canada, performing groin US and then interpreting the results is associated with much higher costs than a clinical evaluation by a general surgeon. Taking our study's finding that only 1.5% of routinely ordered preconsultation groin US examinations affected surgical decision-making, the cost of groin US that does not affect surgical management should be considered as a major unnecessary health care expenditure. In publicly funded health care systems, this finding is of utmost importance. Also, the actual cost of unnecessary routine groin US is likely much higher than we can estimate, as our analysis did not include patients who were not eventually referred to a general surgeon and who likely had negative groin US findings.

After data acquisition and analysis for this study, physician-formulated recommendations were presented to medical authorities and associations in Alberta to advocate for the prevention of unnecessary routine groin US to diagnose inguinal hernias. After a review of available data from multiple sources, including the present study, Choosing Wisely Alberta (whose main goal is to assist physicians in preventing unnecessary testing) included "Don't use ultrasound routinely to evaluate clinically evident inguinal hernias" (<https://www.albertadoctors.org/choosing-wisely-resources>) among its recommendations. As such, groin US ordered to rule out an inguinal hernia in adult patients in Alberta can now be interpreted and claimed by radiologists only if it is ordered by a general surgeon or urologist. We estimate annual savings to be on the order of millions of dollars with the adoption and implementation of this recommendation. This recommendation was also endorsed by Choosing Wisely Canada, under the General Surgery section (<https://choosingwiselycanada.org/recommendation/general-surgery/?highlight=general+surgery>). We suggest that it should be added under the Family Medicine section as well, given how frequently family doctors assess patients for a possible inguinal hernia.

Future studies could further examine whether a subpopulation of patients exists in whom groin US significantly affects surgical decision-making. It would be of interest to follow patients with a small, nonpalpable

inguinal hernia identified on groin US who choose nonoperative management to assess the long-term outcomes of this scenario; to our knowledge, there is currently no published work on this issue. Studies analyzing outcomes of the use of computed tomography or magnetic resonance imaging in patients with a hernia that is not clinically evident but is present on US would be helpful in creating a decision-making algorithm for surgeons faced with this scenario. Also, following up with patients via a clinical satisfaction score after hernia repair would provide insight into whether surgery for occult inguinal hernias is beneficial. Finally, dedicated cost analysis studies could evaluate the annual cost of unnecessary routinely ordered groin US.

Limitations

Our study was retrospective and has the inherent limitations associated with this study design. Also, data gathering did not routinely include surgical findings of the presence of a hernia, which would have contributed to the literature on the sensitivity and positive predictive value of groin US. We also did not analyze data on the reducibility of inguinal hernias, which might have provided insight on the decision to perform surgery.

CONCLUSION

Routine groin US was frequently performed before general surgery consultation, whether a hernia was detectable on CE or not. Positive groin US results alone infrequently affected whether the patient proceeded to surgery. Clinical examination findings played a larger role in surgical decision-making than groin US results. Eliminating the practice of routine groin US may provide considerable health care cost savings. Further investigation to define a subset of the population in whom groin US affects surgical decision-making may help delineate the proper use of this imaging modality.

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