

OPINION

THE PREOPERATIVE ROLE OF HERNIOGRAPHY: REAPPRAISING A FORGOTTEN TECHNIQUE?

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G. Geuens¹, P. Bellinck², R.A. Salgado^{2,3}, B. Op de Beeck³, J.L. Termote², T. Mulkens²

Ever since their description in papyrus manuscripts more than 3500 years ago as "*a swelling above the genitalia which appears on coughing*" by the physicians in ancient Greece, groin hernias have been recognized as a frequently encountered clinical problem (1). The reported estimated lifetime prevalence of groin hernias is 25 per 100 persons (2). Surgery is the recommended definite therapy for symptomatic cases, whereas watchful waiting is often preferred in patients with minimal or no complaints. Given the high incidence of groin hernias and their related economic implications for the community, an accurate diagnosis is desirable to rule out other diseases and to avoid unnecessary surgery. Today, the diagnosis of a groin hernia is in the vast majority of cases still based on the combination of clinical symptoms and physical examination. In case of equivocal clinical findings, various imaging techniques have been evaluated to confirm or rule out the presence of a hernia. Among them, herniography has been proven to be a safe and highly accurate diagnostic procedure, but the technique has not gained widespread acceptance in the daily clinical routine. In this manuscript we will review and discuss pre-operative imaging in the work-up of occult groin hernias with emphasis on the role of herniography. The discussion is restricted to patients who did not undergo previous surgery for hernia.

In 2009, the European Hernia Society (EHS) has published guidelines for the treatment of inguinal hernia, with recommendations from diagnosis till aftercare (3). They conclude and recommend the following:

(1) in case of an evident hernia, clinical examination suffices; only

cases of obscure pain and/or doubtful swelling in the groin require further diagnostic investigation

(2) ultrasound should only be performed if expertise is available, given its low accuracy for diagnosing inguinal hernia in everyday practice

(3) if ultrasound is negative, magnetic resonance imaging (with Valsalva) is recommended, and in case the latter is negative, consider herniography

(4) computed tomography has a limited place in the diagnosis of an inguinal hernia

The authors clearly indicate that those recommendations are not based on randomized controlled trials nor cohort and/or case-control studies of good quality, but only supported by case series or cohort studies of low quality.

Ultrasound imaging is not exclusively performed by radiologists, but also by internal medicine and surgical specialists. The relatively low cost in infrastructure and its widespread use makes ultrasound readily available. As such, this technique is in most clinical routine practices positioned as the modality of choice in the imaging work-up of groin hernias. Ultrasound also allows dynamic evaluation, i.e. imaging with the patient in standing position or while instructing the patient to cough, strain or perform the Valsalva manoeuvre. The combination of a dynamic sonographic evaluation, physical examination and direct patient feedback during the exam, is likely to increase its diagnostic accuracy. This is equally true for both radiologists and non-imaging specialists; the former group having the expertise to concomitantly look for other causes of groin pain (such as musculoskeletal pathology), the

latter being experts in examining and questioning the patient and responsible for the treatment planning. The main patient-related disadvantage of the sonographic technique is its limited quality in obese patients. Furthermore, despite but also because its widespread use, the reported accuracy of ultrasound varies greatly, with a sensitivity ranging between 30% to almost 100% (4-5). This difference in reported accuracy is not only performer-related, but is also reflected in the heterogeneity of patients included in imaging studies, ranging from asymptomatic patients with subclinical hernias to patients with clinically evident hernias. These data support the recommendation of the EHS to restrict ultrasound to clinically non-evident cases with obscure pain and/or doubtful swelling in the groin and when sonographic expertise is available.

In contrast to ultrasound, magnetic resonance imaging (MRI) is almost exclusively performed by radiologists and requires a high-cost infrastructure, rendering this technique less routinely available. The excellent contrast resolution of MRI makes this technique very suitable to depict the inguinal anatomy and hence detect the presence of a groin hernia. A much cited advantage of MRI, which is also valid for ultrasound, is its ability to reveal other causes of groin pain, such as musculoskeletal pathologies. Despite the fact that radiologists generally dislike combined MRI protocols, a specialized clinical examination should be able to differentiate between an inguinal hernia and musculoskeletal disease in the great majority of cases. A clear disadvantage of MRI in the context of a suspected hernia is the necessity to image patients in supine position. According to the EHS guidelines, MRI with Valsalva is recommended in cases when ultrasound is negative. Very few large patient studies examining the accuracy of MRI are available. A good

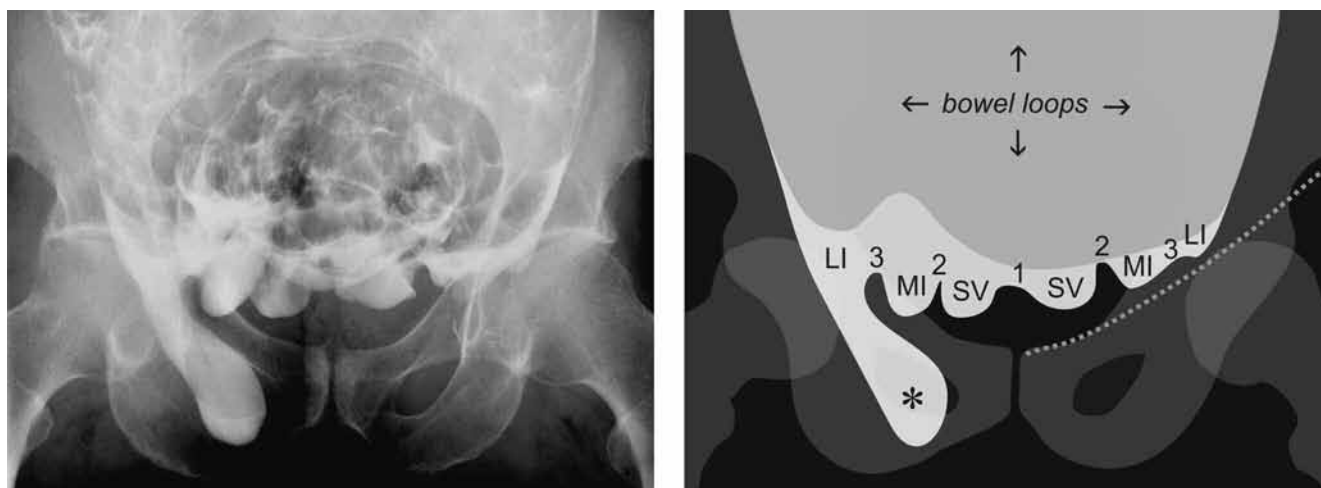


Fig. 1. — Standard anteroposterior herniogram and matching annotated drawing showing the normal anatomy and a right-sided indirect inguinal hernia (*). Abbreviations: LI lateral inguinal fossa, MI medial inguinal fossa, SV supravesical fossa, 1 median umbilical fold, 2 medial umbilical fold, 3 lateral umbilical fold.

example of the lack of good quality data is the much-cited small patient study of van den Berg et al., in which 41 patients with clinically evident herniations (read: no role for imaging) underwent ultrasound and MRI prior to laparoscopic investigation. Based on those 41 evident herniations, the authors conclude that MRI is a valid diagnostic tool in patients with clinically uncertain herniations (6). In a recent large patient study ($n = 113$) of Marien et al., the authors evaluated the role of MRI versus ultrasound in the standing position for the detection of sub-clinical inguinal hernias (7). They concluded that ultrasound was the most sensitive method for detection (sensitivity ultrasound versus MRI was 69 versus 51%). As such, their data do not support the recommendation of the EHS to perform MRI in case ultrasound is negative.

Herniography as a radiologic technique to detect inguinal hernia was

already reported in the late sixties (8). The procedure is performed as follows. The patient is asked to void the bladder prior to the start of the examination and is positioned on the fluoroscopy table in supine position. A puncture site is marked on the skin in the left lower quadrant at the lateral border of the rectus abdominis muscle or at the lateral third of the line connecting the umbilicus with the left anterior superior iliac spine, in order to avoid puncture of the inferior epigastric artery. Interposition of the descending colon is fluoroscopically checked. After disinfection of the skin, local anesthesia of the skin and subcutaneous tissue is performed. Subsequently, 70 to 80 ml of a low osmolar, non-ionic, iodinated contrast material is injected with a fine (22G) needle in the peritoneal cavity under fluoroscopic control. After injection, the table is tilted 20-30° in anti-Trendelenburg position to facili-

tate contrast pooling in the groin regions as the patient is further instructed to perform the Valsalva manoeuvre several times while slowly turning around his axis. Finally, a standard series of images (anteroposterior, oblique and lateral views with and without caudocranial inclination of the X-ray gantry) in the upright position are obtained during straining. Figure 1 shows the normal anatomic structures (and folds) visible on a herniogram together with the presence of a right-sided indirect inguinal hernia. Opposed to ultrasound and MRI, large patient studies with consistent results do exist for herniography. Table I lists studies of > 100 patients evaluating herniography using surgical findings as the gold standard. Like with other imaging modalities, false negative results might be underestimated by the possible absence of subsequent surgery. In a prospective study of Alam et al. with surgery serving as the

Table I. — The accuracy of herniography with surgery serving as the gold standard.

first author	publication	patients n	surgery (%)	PPV (%)	NPV (%)
Ekberg et al.	<i>Radiology</i> 1981	146	20	100	100
Magnusson et al.	<i>Ann Chir Gynaecol</i> 1984	118	30	92	83
Van Ginderachter et al.	<i>J Belge Radiol</i> 1990	120	25	100	100
Mäkelä et al.	<i>Ann Chir Gynaecol</i> 1996	106	46	98	67
Hamlin et al.	<i>Am Surg</i> 1998	306	47	100	90
Sutcliffe et al.	<i>Clin Radiol</i> 1999	112	30	97	98
Hachem et al.	<i>Hernia</i> 2009	170	84	100	100
Hureibi et al.	<i>Eur J Radiol</i> 2010	117	33	100	60
Geuens et al.	<i>Acta Chir Belg</i> 2011	157	34	77	86

Legend: PPV positive predictive value, NPV negative predictive value.

gold standard, the sensitivity of ultrasound in detecting clinically occult hernias was very low (33%), in contrast to herniography (92%) (4). This was confirmed in a large retrospective study (n = 157) we conducted last year in the hospital of Lier, with a similar reported sensitivity of 33% for ultrasound and 83% for herniography (9). Herniography is an invasive procedure and complications can result from [1] puncturing the abdominal wall and [2] adverse reactions to the injected contrast material. In the first category perforation of the intestines (stomach, small and large bowel) and vascular structures (iliac vessels) have been reported as well as hematoma along the puncture course. The reported incidence of accidental perforation of visceral organs is less than 2% (for studies of > 100 patients) and is generally self-limiting or treated conservatively. The calculated major complication rate based on pooled studies was found to be 0.19% in a study by Ng et al. (10). In the second category, the risk of an adverse contrast reaction is similar as for other contrast enhanced examinations. At last, pain is sometimes reported by patients undergoing herniography, during the puncture procedure or as a delayed presentation. Based on these data and opposed to the EHS guidelines, herniography should be recommended when ultrasound is negative. MRI should be reserved for cases with a negative herniogram to exclude the presence of a cord lipoma or to further investigate other cause of groin pain such as musculo-tendinous pathology.

Computed tomography (CT) is the imaging modality of choice for patients presenting with symptoms of a complicated groin hernia. CT is an excellent modality to detect intes-

tinal obstruction, strangulation or perforation caused by an incarcerated hernia. The role of CT in adults to detect occult groin hernias is less well-established. In a recent study of Garvey et al., the authors reviewed the value of CT to detect an occult groin hernia in 158 patients presenting with negative or equivocal clinical findings (11). The authors conclude that CT can be a useful as an adjunct, but experienced clinical judgment remains the critical element in the diagnostic work-up. The use of low-dose CT in the non-acute clinical setting reduces the damaging effect of ionizing radiation. As also mentioned for MRI, a disadvantage of CT is the necessity to image patients in supine position.

In summary, herniography is a safe technique with a consistent high accuracy to detect occult groin hernias in patients with unclear but suspicious clinical presentation. Ultrasound needs a specific expertise, which is reflected in the wide range in reported sensitivity in patients with equivocal clinical presentation. CT is the imaging modality of choice for patients presenting with symptoms of a complicated groin hernia. The lack of good quality studies, supine imaging setup and higher costs, do not support a role for MRI in the initial imaging work-up of groin hernias.

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