## Case 15283

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### Giant ventral incisional hernias with loss of domain: what the radiologist needs to know

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DOI: 10.1594/EURORAD/CASE.15283 ISSN: 1563-4086 Section: Abdominal imaging Area of Interest: Abdominal wall Procedure: Diagnostic procedure Imaging Technique: CT Special Focus: Hernia Case Type: Clinical Cases Authors: Tonolini Massimo, MD. Patient: 75 years, female

#### **Clinical History:**

A 75-year-old obese woman had a history of remote psychiatric disease, surgically resected breast carcinoma (over ten years) and open cholecystectomy 9 years earlier. Currently, she was hospitalised because of anaemia from bleeding endometrial atrophy, with stable vital signs.

The key physical finding was represented by a large incisional ventral hernia.

#### **Imaging Findings:**

The patient was being considered for combined hysterectomy and ventral abdominal hernia repair using a prosthetic mesh.

Unenhanced multidetector CT (Figs 1 and 2) confirmed a giant incisional hernia at the ventral abdominal wall, containing abdominal fat, colon and small bowel loops, associated with atrophied rectus muscles. Easy CT measurement of the hernia sac volume (HSV, 2267 cm3) and abdominal compartment volume (ACV, 6937 cm3) using the approximate ellipsoid volume formula resulted in a HSV / ACV ratio of 32.6%, consistent with loss of domain. Additionally, the diameters and angle of the abdominal wall defect were measured in the CT report. Surgery was ultimately postponed because of sepsis from urinary infection and rhabdomyolysis following accidental fall.

#### **Discussion:**

Incisional hernias (IHs) involve protrusion of abdominal fat and viscera through a post-surgical defect in the abdominal wall, and are nowadays becoming more prevalent due to the overweight epidemic and the growing complexity of surgeries. The combined effect of obesity and associated cardiorespiratory and metabolic comorbidities increase the risk of IH development, the complexity of surgical repair, and the rate of postoperative complications. Currently, a significant proportion (approximately 11%) of all hernia repair procedures is performed to manage giant ventral IHs (GVIHs), which severely impact the patients' quality of life. Unfortunately, no consensus definition exists and a GVIH is variably diagnosed on the basis of maximum hernia sac width exceeding 10-15 cm, or of a large hernia sac volume (over 100-200 cm3). GVIH repair is technically challenging and burdened with unacceptable high postsurgical mortality (up to 5%), morbidity (34-50%) and recurrence rates (up to 50%), proportionally increasing with hernia size [1, 2].

Additionally, surgeons recently rely on the concept of "loss of domain" (LOD) which is calculated as the hernia sac-to abdominal cavity volume ratio. GVIHs with LOD >30% are associated with prolonged postoperative hospitalisation and frequent recurrence. The most dreaded early complication is abdominal compartment syndrome, which results

from forcing back abdominal viscera from long-standing GVIH into a smaller abdominal cavity, causing impaired blood flow and cardiopulmonary failure [3].

As a result, radiologists are increasingly requested to preoperatively assess IHs, in order to improve success of surgical repair. As this typical case exemplifies, multidetector CT with optional intravenous contrast and/or oral bowel opacification is beneficial for preoperative surgical planning. The technologist should ensure to include the entire abdominal girth in the field-of-view, and reconstruct images along three (namely axial, coronal and sagittal) planes. In a few minutes, the attending radiologist can add value to the report by measuring hernia sac and abdominal cavity diameters and calculating HSV, ACV (Fig.1) and LOD which represents the HSV / ACV ratio. Additionally, the abdominal defect diameters and angle should be measured (Fig.2), the bulk and symmetry of the abdominal wall musculature can be observed [4-8].

In fact, CT findings are useful to predict the need for complex surgical techniques for abdominal wall reconstruction. For instance, progressive pneumoperitoneum is strongly suggested for LOD>25% with better results compared to standard on-lay mesh repair. On the other hand, wide-angle (>20°) GVHIs are approached using combined midline fascial reapproximation, anterior component separation and sublay prosthetic mesh [3, 9, 10].

**Differential Diagnosis List:** Giant ventral incisional hernia with loss of domain, Ventral hernia without significant loss of domain, Abdominal wall tumour

Final Diagnosis: Giant ventral incisional hernia with loss of domain

#### **References:**

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## Figure 1



**Description:** Axial (a) and coronal (b) CT images allowed easy measurement of maximal transverse section (calipers in a) and craniocaudal diameter (caliper in b) of large ventral hernia sac, containing fat, colon and small bowel loops. **Origin:** Tonolini M, Radiology Department, "Luigi Sacco" University Hospital – Milan (Italy)



**Description:** Axial (a) and coronal (b) CT images allowed easy measurement of maximal transverse section (calipers in a) and craniocaudal diameter (caliper in b) of large ventral hernia sac, containing fat, colon and small bowel loops. **Origin:** Tonolini M, Radiology Department, "Luigi Sacco" University Hospital – Milan (Italy)

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#### Table 1: Assessment of hernia sac volume (HSV)

Measure transverse hernia sac diameter (H1): on axial CT images, draw horizontal segment between parietal peritoneum of hernia sac at its maximal width Measure <u>anteroposterior</u> hernia sac diameter (H2): on axial CT images, draw vertical segment between ventral aspect of parietal peritoneum in hernia sac and anterior limit of abdominal cavity (line connecting muscles on each side of the anterior abdominal wall) Measure <u>craniocaudal</u> hernia sac diameter (H3): on coronal or sagittal CT images, draw vertical segment between parietal peritoneum at uppermost and lowermost limits of hernia sac Calculate HSV = H1 \* H2 \* H3 \* 0.52 (ellipsoid volume formula)

**Description:** Table explaining assessment of hernia sac volume (HSV) (see Figs.1a-b). **Origin:** Tonolini M, Radiology Department, "Luigi Sacco" University Hospital – Milan (Italy)



**Description:** Axial (c) and coronal (d) images showing measurement of maximal transverse section (calipers in a) and craniocaudal diameter (caliper in d) of intra-abdominal compartment. Note symmetrically thin, atrophied rectus muscles. **Origin:** Tonolini M, Radiology Department, "Luigi Sacco" University Hospital – Milan (Italy)



**Description:** Axial (c) and coronal (d) images showing measurement of maximal transverse section (calipers in a) and craniocaudal diameter (caliper in d) of intra-abdominal compartment. **Origin:** Tonolini M, Radiology Department, "Luigi Sacco" University Hospital – Milan (Italy) **f** 

#### Table 2: Assessment of abdominal cavity volume (ACV)

Measure transverse abdominal cavity diameter (A1): on axial CT images, draw horizontal segment between parietal peritoneum on each side of the abdomen at its maximal width Measure anteroposterior hernia sac diameter (A2): on axial CT images, draw vertical segment between anterior limit of abdominal cavity (line connecting muscles on each side of the anterior abdominal wall) and a line passing through transverse processes of lumbar vertebrae Measure craniocaudal hernia sac diameter (A3): on coronal or mid-sagittal CT images, draw vertical segment between diaphragm and upper aspect of perineum Calculate ACV = A1 \* A2 \* A3 \* 0.52 (ellipsoid volume formula)

**Description:** Table explaining assessment of abdominal cavity volume (ACV) (see Figs.1d-e). **Origin:** Tonolini M, Radiology Department, "Luigi Sacco" University Hospital – Milan (Italy)

## Figure 2



**Description:** Sagittal (a) and axial (b) images allowed rapid measurement of longitudinal (caliper in a) and transverse (caliper in b) diameter of abdominal wall defect, respectively. **Origin:** Tonolini M, Radiology Department, "Luigi Sacco" University Hospital – Milan (Italy)



**Description:** Sagittal (a) and axial (b) images allowed rapid measurement of longitudinal (caliper in a) and transverse (caliper in b) diameter of abdominal wall defect, respectively. **Origin:** Tonolini M, Radiology Department, "Luigi Sacco" University Hospital – Milan (Italy)



**Description:** Additionally, on the axial plane the defect angle (calipers) relative to a fixed point at the ventral aspect of lumbosacral vertebrae may be calculated. **Origin:** Tonolini M, Radiology Department, "Luigi Sacco" University Hospital – Milan (Italy)