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Abdominal wall desmoid tumors: A proposal for US-guided resection

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ABSTRACT

BACKGROUND: Desmoid tumors (DTs) is a benign tumor with high tendency to infiltrative evolution and recurrence. Nowadays, in abdominal localization, the standard approach is surgery with R0 condition. The need to repair post-surgical wide wall defect requires conservative technique to decrease the incidence of incisional hernia and to obtain better quality of life (QoL).
METHODS: We perform an abdominal wall desmoid resection using ultrasound guide. This technique ensures to spare a wide wall area and to obtain a multilayer reconstruction minimizing postoperative risk. This approach allows good oncological results and better managing abdominal wall post-resection defect.
RESULTS: We use US guided surgery to get radical approach and wall tissue spare that allows us a multilayer reconstruction minimizing post-operative complications. No recurrences were observed in one year follow up period.
CONCLUSION: Our experience represents first step to consider ultrasound mediated technique usefull to optimize wall resection surgery and to minimize following complications.

1. Introduction

DTs, also known as aggressive fibromatoses, are benign myofibroblastic neoplasms originating from muscular aponeuroses that are also classified as deep fibromatoses [1]. They constitute 3% of all soft tissue tumors and 0.03% of all neoplasms [2]. Despite their aggressive local infiltration, DTs lack metastatic potential [3]. However, the local infiltrations and compressions of surrounding structures demonstrate an high recurrence rate, and in specific anatomic localizations with restricted access to surgical resection (i.e., extra-abdominal tumor invading nerves ad vases), may lead to fatalities [4]. The appearance of DTs depends on the relative amounts of fibroblast proliferation, fibrosis, collagen content, and vascularity of the tumor. At US they are masses of low, medium, on high echogenicity with smooth, sharply defined margins. The lateral borders may appear ill defined or irregular [5]. DTs usually occur in fertile females and are uncommon during the menopause; during pregnancy an increase in volume occasionally occurs in already existing tumors. This supports the estrogen-stimulated tumor growth hypothesis [6]. Numerous studies have demonstrated that 37–50% of DTs are initiated in the abdominal area [7]. Abdominal DTs occur sporadically or are associated with certain familiar syndromes, such as familiar adenomatous polyposis (FAP) [8].

2. Case report

A 41-year-old female was admitted to the Department of General and Urgent Surgery of Santa Maria delle Croci Hospital, in Ravenna, Italy presenting an abdominal wall mass in the left anterolateral sector. During a physical examination, the mass was observed to be firm, lacking tenderness and fixed to the abdominal wall. The patient stated that the mass was in rapid dimensional growing in the last 4 months and painful in daily activities. The skin surrounding showed a scar sited cranially, mobile respect the wall mass as outcome of a previous surgical exploration in a primary hospital without subsequent resection. She was referred to our unit observation to precise adequate diagnosis and receive adequate cure. The patient had no familiar oncological past and no history of smoking, drinking alcohol or referred trauma. She took psychotropic medication. The analyzed blood parameters were within the normal range and the tumor markers were all negative. Pre-operative MRI scans revealed a nodular mass measuring 7.8 × 6 cm in diameter with quite regular edge and attenuation equal to the muscle. The mass originated from the cranial portion of the left rectus abdominis muscle and, following intravenous

Abbreviations: WIOUS, wall intraoperative US exploration; QoL, quality of life; US, ultrasuond; DTs, desmoid tumors; FAP, familiar adenomatous polyposis.

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Fig. 1. Desmoid in RMN preoperative study.

administration of contrast medium, demonstrated disomogeneus enhancement, being hyperintense in T2 compared to muscle tissue (Fig. 1). Because of the symptomatic setting, the tumor resectability and the gradual dimensional impairment, the patient was inserted in an operative program with a previous US exploration performed to check any dimensional variation and at the meantime to try to carry on a "US guided resection". Planning technical strategy we decided to use a non-cross-linked biological prosthesis, size 20×20 cm, to obtain an adequate marginal overlap circumferentially and a comfortable adaptability for possibility of a future pregnancy and for daily physical activities.

3. Technical findings

Surgical technique was based on preoperative US exploration with a convex high frequency (3.5–5.5 MHz) probe to define the lesion margins and depth before cutting and draw the incision plot to minimize its length having an adequate mass exposure at the same time (Fig. 2). We used a subcostal curve shaped incision, 1 cm caudally the lesion skin projection to obtain a wide surgical view preserving skin edge vascularization. Considering previous

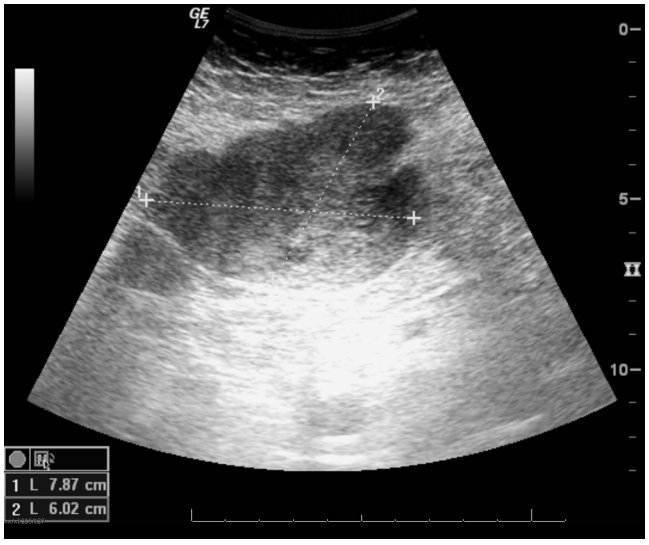


Fig. 2. Preoperative US exploration.

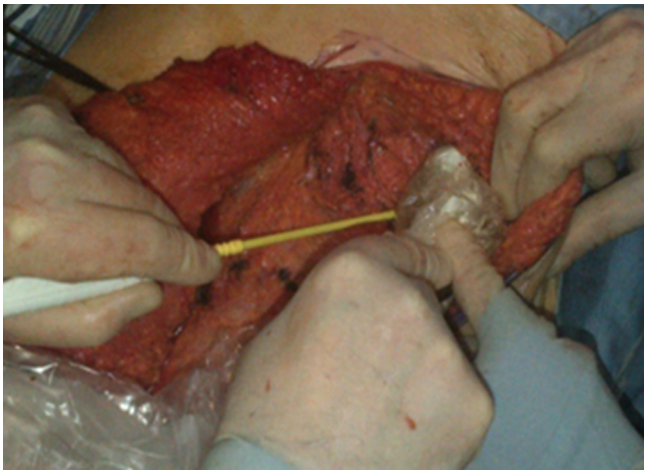


Fig. 3. WIOUS exploration. We put the electric scalpel under the probe to detect the right point of dissection using the metal knife image on US.

US-description, we got deep fat tissue dissection till lesion upper margin. The following dissection was along wall plan in fat tissue upper the fascia preserving an oncological safe margin. Deep "wall intraoperative US exploration" (WIOUS) described circumferential margin underling the transition area between DT and surrounding free muscle tissue with a distance from the center of the lesion of 4 cm (x), which is the lesion radius (Figs. 3 and 4). Positioning the probe across the transition area and electric scalpel under it, we got a larger incision with 1 cm safe margin ($x + 1$), using the shadow of metal knife on US image to define the right point of safe dissection. This technique allows us to look through the wall thickness and to avoid useless tissue sacrifice all around the lesion. We can burn the fascia by turns taking away the probe and obtain a plot that describes the resection circle area with radius $r = (x + 1)$. Deeply, the dissection was till peritoneal plane because of desmoid infiltrated deeper layers without nevertheless visceral invasion (Fig. 5). Subsequent reconstruction was obtained using "Rives technique" by lateral muscle flaps mobilization according to "Ramirez component separation technique" [9]. Macroscopically, the tumor had a solid texture, had no confirmed capsule, and its margins was ill-defined. The definitive histological diagnosis was "Desmoid tumor with free skeletal muscle margins and negative ER-PR receptors". The course was uneventful, and the patient was discharged on the seventh post-operative day. After a follow-up of 12 months after surgery, the patient is in good condition and complete remission, without

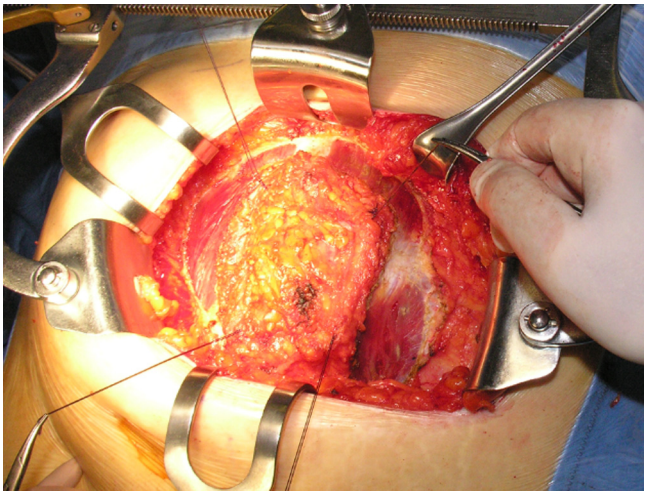


Fig. 4. Surgical US guided margins: lesion radius plus 1 cm (r).

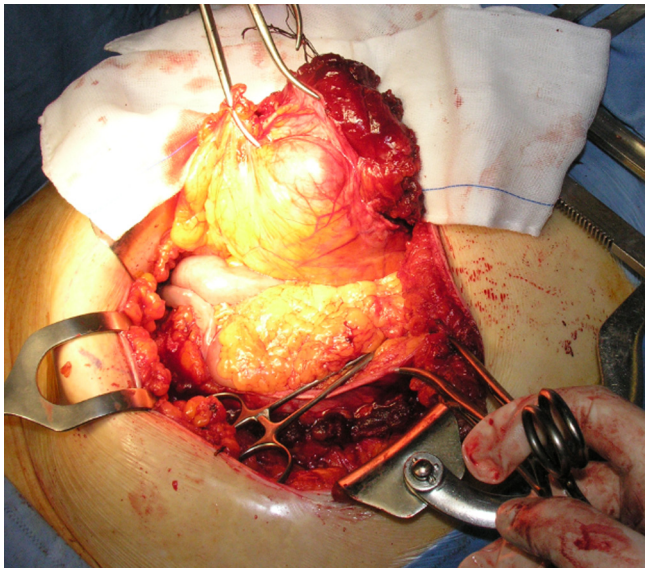


Fig. 5. All thickness infiltrative lesion resection.

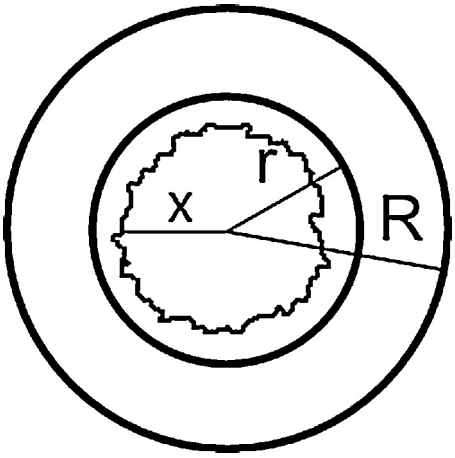
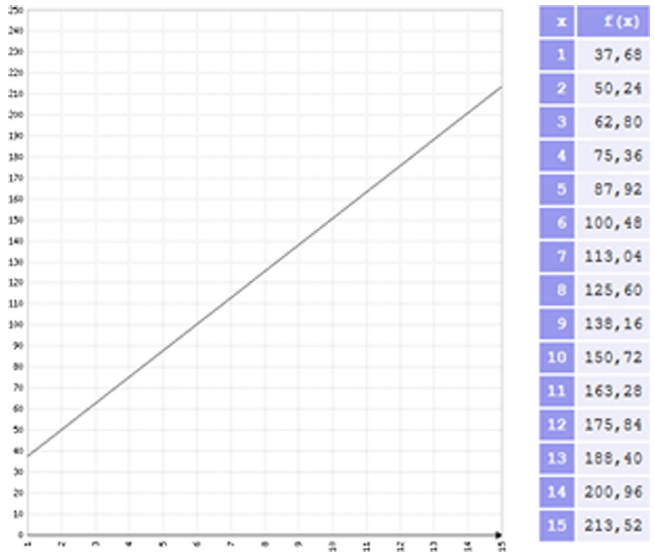


Fig. 6. Different technical of lesion resection: x = lesion radius; r = lesion radius plus 1 cm in US guided resection; R = lesion radius plus 3 cm in "classical resection".

any other treatment. She presents a cosmetic scar, no functional limits, wall bulging or recurrence findings.

4. Discussion

DTs are rare in the young and in the elderly, people between the ages of 15 up to 60 are most commonly affected. They are slightly more common in women than in men [10] and there is not significant racial or ethnic nexus. Major incidence in young patients means that in post-operative period we can see childbearing, fast coming to job and higher incisional hernia incidence. Nevertheless, the mean prognostic criterion came from macroscopical margin lesion that must be disease free [11]. Often obtaining free disease margins opposes to avoid wide wall defect, marginal hernia, postoperative wall bulging and functional loss. We consider important thinking about a new approach that allows to obtain oncological radicality, minimal wall loss with a potential application of conservative surgery, like in children [12]. We got a "US guided sparing resection" considering this approach usefull to identify minimal tissue safe margins, obtaining an oncologically correct resection and the best reconstruction opportunity. This is possible because the DT shape is recognizable by US, allowing to obtain a



x	f(x)
1	37,68
2	50,24
3	62,80
4	75,36
5	87,92
6	100,48
7	113,04
8	125,60
9	138,16
10	150,72
11	163,28
12	175,84
13	188,40
14	200,96
15	213,52

Graphic 1. The variation of spared wall tissue area is directly depending on lesion radius. On graphic and on table is represented the relationship between radius value and relative spared area.

well defined free margin. This approach could minimize the recurrences [11] and decreases the loss of tissue at 1 cm instead of 3–5 cm of the currently technique [13,14]. Using WIOUS, it could obtained a spared circular ring tissue, which area (S) is calculated from difference of two circles obtained by "classical resection" (πR^2) and by WIOUS guided resection (πr^2), in which R is the lesion radius (x) plus 3 cm and r is x plus 1 cm of free tissue. The circular ring formula (Fig. 6) is $S = \pi R^2 - \pi r^2$ or $S = \pi(R^2 - r^2)$. Considering the circular ring area depending on lesion radius, it can be deduce by the function $f(x) = \pi[(x+3)^2 - (x+1)^2]$ (Graphic 1). Observing the values obtained we can say that using the WIOUS guided resection allows a wall sparing area that increases directly with the lesion radius. In our patient with a DT with major radius of approximately 4 cm, we spared with our technique about 75 cm^2 abdominal wall surface.

5. Conclusion

This technique can be associated with other wall surgical approach as "component separation technique" or muscle flap preparation to define the best reconstructive strategy minimizing the heavy consequences of a wide wall full-thickness resection. This approach can be associated with biological prosthesis to obtain the best results regarding postoperative wall arrangement and day life quality. Using WIOUS guided resection, we can spare free wall tissue that is often necessary to obtain a pre-peritoneal prosthetic reconstruction having less recurrence index than we could have using in-lay or on-lay reconstruction [15]. This novel approach seem to reduce the complication rate in wide tissue loss procedure, achieving free tissue for "marginal lesions" in which is more difficult to obtain a muscle flap and an adequate overlap prosthesis reconstruction. We can apply a no touch technique minimizing microscopic spreading cancer and recurrence rate. However, this approach presents some limits: lack of series to confirm oncological validity, surgeons with radiological skills, possibility of ultrasound availability in operating room. Nevertheless, this new approach could be an example of integrated surgical technique, like we can see in other anatomical district in which the surgeon uses US like a proper essential device.

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy

of the written consent is available for review by the Editor-in-Chief of this journal on request.

Conflicts of interest

The authors have no financiall disclosures or conflicts of interest to declare.

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Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Author contribution

Stefano Bolzon – Study design and writing.
Alessio Vagliasindi – data collection.
Federico Zanzi – data analysis.
Marco Negri – contributor.
Gian Piero Guerrini – contributor.
Camilla Rossi – writing.
Paolo Soliani – writing.

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