Ultrasound Therapy in Rectus Sheath Hematoma

Background and Purpose. Ultrasound (US) is one of the most common modalities used in intervention for musculoskeletal disorders, although its effectiveness is debated. The purpose of this case report is to describe the intervention, including the use of US, in the management of a large rectus sheath hematoma (RSH) in a patient receiving anticoagulant therapy. Case Description. The patient was a 62-year-old woman with RSH who was receiving oral anticoagulant therapy and had a history of bouts of coughing. Computed tomographic scans verified the diagnosis of RSH. The report describes the patient examination, management, intervention, and outcomes. Outcomes. The intervention, including the use of US therapy, may have enabled a rapid resolution of the hematoma. Discussion. This case report illustrates how US may be a useful modality for complementary management of RSH, helping the reabsorption of the hematoma. [Berná-Serna JD, Sánchez-Garre J, Madrigal M, et al. Ultrasound therapy in rectus sheath hematoma. Phys Ther. 2005;85:352–357.]

Key Words: Abdominal wall, Electrophysical agents, Hematoma, Muscle, Ultrasound.

Juan D Berná-Serna, Juan Sánchez-Garre, Manuel Madrigal, Isabel Zuazu, Juan D Berná-Mestre
Rectus sheath hematoma (RSH) is an uncommon and often misdiagnosed condition. The most frequent location is infraumbilical. The causes of RSH described in the literature include anticoagulant therapy, hematological disorders, trauma, physical exercise, coughing, sneezing, pregnancy, and hypertension. The most frequent predisposing factor is anticoagulant therapy, and the most important precipitating factor is coughing. Rectus sheath hematoma can be suspected in women above 60 years of age who have the clinical triad of acute abdominal pain, an abdominal mass, and anemic syndrome. If RSH is suspected or ultrasound (US) imaging indicates RSH, computerized tomographic (CT) investigation of the abdomen must be carried out immediately. With early diagnosis and conservative management, surgical intervention can be avoided even with large hematomas. We consider conservative intervention for large hematomas (types II and III) to be normalization of coagulation parameters by administration of vitamin K1 and fresh frozen plasma. Blood transfusion is performed in all type III hematomas. In type I (slight) hematomas, symptomatic intervention using analgesics is considered adequate. Clinical improvement is usually rapid in patients with type I or II RSH. Spontaneous resolution of RSH, especially in large hematomas (type III), however, takes place over several months. Surgical intervention would be indicated primarily in cases in which hemodynamic stability is not achieved. Hemodynamic stability is defined as sustained control of the hemodynamic parameters (control of central venous pressure, blood pressure, hearing rate, and diuresis).

Ultrasound is used widely as a diagnostic, operative, and therapeutic tool. For instance, diagnostic US is used for the diagnosis of gallstones, operative US is used as a harmonic scalpel, and therapeutic US is used in the management of tendinitis or muscle tears. Ultrasound is the most widely available and the most frequently used electrophysical agent in physical therapy. Ultrasound is used in the management of a wide range of musculoskeletal disorders. The effects of US for patients with musculoskeletal disorders, which occur through a variety of biological and physical mechanisms, include muscle relaxation, reduced swelling, and pain relief. Most knowledge of the effects of US on living tissue has been gained through in vitro studies and animal models, but relatively little in vivo evidence that these effects actually occur has been published. Ultrasound can induce thermal and nonthermal physical effects in tissues. In a review of the purported effects of therapeutic US, Speed concluded that the thermal effects of US may include increased blood flow, reduction of pain, reduction of muscle spasm, increased tissue extensibility, and a mild inflammatory response. Nonthermal effects may include cavitation and acoustic microstreaming. A combination of thermal and nonthermal effects may result in stimulation of fibroblast activity, increased protein synthesis, increased blood flow, and tissue regeneration. Nonetheless, the effectiveness of US remains questionable.

Therapeutic US can be pulsed or continuous. Ultrasound at a frequency of 1 MHz is absorbed primarily by tissues at a depth of 3 to 5 cm; a frequency of 3 MHz is recommended for more superficial lesions at depths of 1 to 2 cm. To our knowledge, the use of US therapy in the management of RSH has not been reported in the literature. We reasoned that applying pulsed US would produce nonthermal effects through an increase in acoustic microstreaming and an acceleration of fibrinolysis, which might accelerate the reabsorption of RSH. The purpose of this case report is to describe the...
management and outcomes of a patient with a large RSH secondary to oral anticoagulant therapy.

**Case Description**

**Patient History**
The patient was a 62-year-old woman with a history of a catarrhal process who had been receiving oral anticoagulant therapy for 9 months because of atrial fibrillation. Following a bout of coughing, she experienced sudden abdominal pain. Forty-eight hours later, she was admitted to the emergency department of our hospital with persistent abdominal pain, nausea, vomiting, and a positive Murphy sign. These signs and symptoms suggested acute cholecystitis. The patient was hospitalized for 9 days, and her surgeon and hematologist agreed to a conservative management approach. This case was chosen to illustrate multidisciplinary coordination in the management of a large RSH, which included US, and avoidance of surgical intervention and its possible complications.

**Examination**
On physical examination, a tender mass (12 × 8 cm) of soft consistency over the infraumbilical right abdomen was detected. The US examination showed a predominantly echogenic image, indicating that the hematoma had a coagulation component. The CT findings revealed a hypodense mass (Figure, top image). Based on the CT classification described previously, the hematoma was classified as type III. The laboratory data on admission indicated excessive anticoagulation with an international normalized ratio (INR) of 5.2, which was well above the recognized correct range (2–3.5). The patient’s hemoglobin level was 8.7 g/dL (normal range=12–16 g/dL), the hematocrit level was 31.2% (normal range=36%–47%), the platelet count was 300,000/µL (normal range=125,000–450,000/µL), and the leukocyte count was 21,400/mL (normal range=4,000/mL–11,000/mL).

**Medical Management**
Oral anticoagulant therapy was stopped. Bed rest, intravenous hydration, and ice over the abdominal mass were prescribed. An emergency management procedure was used, starting with a reversal of anticoagulation by intravenous administration of vitamin K1 and fresh frozen plasma (15 mL/kg). Blood transfusion also was required. Monitoring of coagulation parameters took place every 6 to 8 hours, and the INR returned to normal 8 hours after intervention began. Administration of vitamin K1 and fresh frozen plasma was suspended 20 hours after admission, when laboratory data indicated that bleeding had ceased. Anticoagulation therapy was reintroduced 24 hours later by adjusting the dose of heparin according to the coagulation parameters, clinical hemorrhage (depending on hemoglobin level and hemodynamic stability), and risk of thromboembolism. The procedure started with intravenous unfractionated heparin in prophylactic doses of 100 IU/kg/d and continued with subcutaneous low-molecular-weight heparin (enoxaparin) in doses of 2,850 IU anticoagulation factor Xa every 12 hours. Treatment with oral anticoagulants (coumarin) was restarted 8 days after the heparin, and the patient started receiving US therapy on the following day. At that point, the patient still had discomfort and the mass in her abdomen persisted. Pain intensity was measured using a 6-point verbal description scale (0=no pain, 1=mild, 2=discomforting, 3=distressing, 4=intense, 5=excruciating). The patient rated her pain at this point as 2 (discomforting).

**Ultrasound Intervention**
Ultrasound therapy was initiated on an outpatient basis 9 days after the diagnosis of RSH. We believe that US therapy should not be administered when the hematoma is recent because of the risk of new bleeding. It must be applied when the hematoma is organized (when US imaging shows a predominantly hypoechogenic mass) and the coagulation parameters are within the correct range (INR=2–3.5). Pulsed US was used because this non-thermal option is thought to involves less risk of bleeding than thermal US (continuous wattage) mode. We instructed the patient to rest and avoid physical effort and to return to the hospital if signs of abdominal pain appeared.

The treatment area was determined by reference to the ultrasonographic findings, and it was limited to an area between 40 and 60 cm². This was followed immediately by US therapy around the RSH area at 1.5 to 2 W/cm² for 8 to 12 minutes per session. A frequency of 1 MHz was used because the RSH was situated at a depth of more than 2 cm because of abundant subcutaneous fat. The transducer head had an area of 6.2 cm², an effective radiating area of 5 cm², and a beam nonuniformity ratio of 1.5 (duty cycle=20%). We used circular movements of the transducer, without angulations, and we used a coupling gel to cover the surface of the skin over the area of the hematoma. Ultrasound therapy was administered once a day, 5 times per week for 4 weeks, for a total of 20 sessions. Weekly assessments by US imaging were performed to determine the status of the RSH. The patient underwent US imaging at the end of US therapy and also after a 2-week follow-up. A CT scan was performed at the end of US therapy.

**Outcomes**
After the first 5 sessions of US therapy, the abdominal discomfort ceased and a progressive diminution of the abdominal mass was observed. Ultrasound imaging after 2 weeks of US therapy showed that the hematoma was...
Figure.
A case of type III hematoma before ultrasound therapy (top) and after intervention (bottom). Computed tomographic (CT) scan showing hematoma (arrows, top image); CT scan showing slight asymmetry of the rectus muscle (arrow, bottom image).
reduced to less than half of its initial size (ie, from a diameter of 12 cm to a maximum diameter of 5 cm). Later US imaging showed that the hematoma diminished progressively almost to the point of total resolution by the end of 4 weeks of US therapy, and no evidence of abdominal mass was observed on physical examination.

Ultrasound imaging after intervention indicated resolution of the hematoma. Ultrasonographic findings after intervention revealed a small, elongated anechoic image. This ultrasonographic finding, residual to the reabsorption of the hematoma, had disappeared when US imaging was performed 2 weeks after intervention ended. The CT findings following intervention showed a slight asymmetry of the rectus abdominis muscle (Figure, bottom image).

No complications were observed with the application of the US therapy. At 3 and 6 months after cessation of US therapy, the patient was asymptomatic, and her physical condition was normal in follow-up examinations carried out in our hospital by the surgeon involved in the case.

Discussion

Rectus sheath hematoma nearly always presents acutely with sudden onset of abdominal pain and may mimic a variety of abdominal pathologies, such as appendicitis, perforated ulcer, ovarian cyst torsion, intestinal obstruction, ectopic pregnancy, or tumor.2,4,6,7,19 Ultrasound and CT are the imaging methods of choice for the diagnosis of RSH.2,8–10 The intervention of choice is conservative.2,4,9,10 Surgical intervention is indicated primarily in those cases where hemodynamic stability is not achieved.5

Our patient had RSH with a clinical picture of abdominal pain, an abdominal mass, and anemic syndrome. This condition usually appears after a bout of coughing. The RSH was observed in US images and CT scans. The patient had a favorable outcome following conservative management and pulsed US. Resolution of the abdominal mass was rapid. We recommend ultrasonography to determine the area for intervention with US therapy, without clotting dysfunction, to determine an optimal management and pulsed US. Resolution of the hematoma was rapid. We recommend ultrasonography to determine the area for intervention with US therapy, with weekly ultrasonography to assess the size of the hematoma. The weekly assessments also serve as a guide during intervention so the physical therapist knows when to stop the series of US applications. Berná and colleagues2,10 described patients with RSH type III who had a similar clinical profile to that of our case and who underwent conservative management but did not receive US therapy. A comparison of our case with the findings of Berná and colleagues2,10 shows that the time of resolution of the hematoma was ≥3 months in their subjects and <1 month in our case. Spontaneous resolution of RSH, especially in large hematomas, takes place over several months,2,10 with the risk of infection of the hematoma. Several cases of infected hematomas have been reported.2,6,9

Ultrasound therapy is often used in sports medicine and physical therapy. Although little evidence about benefits in the management of soft tissue injuries exists,12,15,15,16 we consider that its lack of use results from the lack of information about the capabilities of US therapy. We applied this intervention as a result of information from a physical therapist in our hospital. The outcomes suggest that US therapy accelerates the reabsorption of the hematoma and quickly relieves the abdominal pain. This reabsorption was observed on clinical examination, and the almost-total resolution of the hematoma was observed in US images and CT scans in less than 1 month. In a recent experimental study, Neuman et al22 referred to the potential of US as an adjunct to antithrombotic therapy to improve effectiveness without increasing the risk of bleeding complications during intervention for vascular thrombosis. Devcic-Kuhar et al23 indicated that US therapy accelerates thrombolysis in vitro. In an in vitro study,18 enhancement of fibrinolysis using US was observed, and the authors concluded that US at 1 MHz potentiates enzymatic fibrinolysis by nonthermal means. The findings of another in vitro study10 suggested that US accelerates thrombolysis.

In order to prevent risk of new bleeding, we believe it is important that US therapy should not be initiated until the acute phase of the hematoma has passed. Although pulsed US is not contraindicated in the management of hematomas, we use this mode only after the first few days of the episode have passed.

We believe that conservative management of RSH, especially in cases of large RSH, requires close coordination of the surgeon, radiologist, hematologist, and physical therapist. To further evaluate the efficacy of US therapy in the resolution of RSH, future research will be needed, such as randomized clinical trials to determine the usefulness of US for managing hematomas in people without clotting dysfunction, to determine an optimal protocol for the management of hematomas, and to provide greater knowledge of the physiologic mechanisms of the effects of US on hematoma.

References


356 . Berná-Serna et al


