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CAN COMPUTED TOMOGRAPHY PREDICT WHETHER SPONTANEOUS RECTUS SHEATH HEMATOMAS ARE CAUSED BY COAGULOPATHY?

ABSTRACT

Spontaneous rectus sheath hematomas may occur spontaneously due to anticoagulant use and cough. Rectus sheath hematoma frequency increased with more use of anticoagulants. This study was aimed to evaluate the success of CT, which has a high sensitivity in detecting rectus sheath hematomas, in predicting whether spontaneous rectus sheath hematomas are caused by coagulopathy or not. Cases with rectus sheath hematoma in the radiology archive of our hospital were included in the study. Cases with a history of trauma, surgery, or abdominal injection were excluded from the study. Twenty-four cases evaluated as spontaneous rectus sheath hematoma were divided into two groups according to the international normalized ratio (INR) result as anticoagulant-related rectus sheath hematoma (14 cases) and non-anticoagulant-related rectus sheath hematoma (10 cases). Fluid cellular level in the hematoma (1), heterogeneity (2), localization at the infra-umbilical level (3) and stranding of subcutaneous fat tissue in the abdominal wall (4), were evaluated as anticoagulant-related rectus sheath hematoma CT findings. Hematoma at the supra-umbilical or umbilical level was considered as hematoma unrelated to anticoagulant use. Diagnostic accuracies were confirmed by laboratory results. Categorical data were compared with chi-square and numerical data using Mann–Whitney U test. While 17 (70.8 %) of the cases were female, only 7 (29.2%) were male. While rectus hematomas are mostly seen in isolation at the umbilical or supraumbilical level of the rectus muscle in the group with no anticoagulant use, it is mostly seen at the infra-umbilical level in the group with anticoagulant use ($p = 0.001$). Stranding in subcutaneous fatty tissue accompanying rectus hematoma is mostly seen in the group with anticoagulant use ($p < 0.001$). Besides, the incidence of heterogeneity in hematoma due to anticoagulant use has increased ($p = 0.035$). No statistically significant difference was found between the two groups in terms of fluid cellular levels in the hematoma. In spontaneous rectus hematomas accompanied by coagulability, the hematoma is mostly localized at the infra-umbilical level. Also, subcutaneous fatty tissue stranding is more common.

Keywords: Hematoma, Rectus Sheath, Computed Tomography, Anticoagulant, Fatty Stranding

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1. INTRODUCTION

Spontaneous rectus sheath hematoma (SRSH) is the occurrence of bleeding without trauma, surgery, or intervention. The frequency of SRSH increases with the use of anticoagulants [1]. Rectus sheath hematomas are intramuscular hematomas caused by damage to the epigastric arteries. Known risk factors are coagulation disorders, advanced age, and pregnancy [2]. Patients often present with sudden onset of nonspecific abdominal pain which can mimic acute abdominal emergency. In addition, a palpable mass in the abdomen is another reason for presentation. Since clinical findings are often non-specific, imaging findings are important. In computed tomography, a hematoma can be observed completely hyperdense or heterogeneously consisting of hypodense-hyperdense areas due to clot and serum. In addition, fluid cellular levels and heterogeneity have been reported in anticoagulant-related abdominal hematomas [3 and 4]. There is a need to evaluate CT findings in SRSH. The aim of the study is to evaluate the success of computed tomography (CT) in predicting RSH secondary to anticoagulant use.

2. RESEARCH SIGNIFICANCE

We aim to contribute to the literature by investigating the capabilities of CT in the diagnosis of SRSH caused by coagulopathy.

3. MATERIALS AND METHODS

The cases with rectus sheath hematomas were retrospectively evaluated between January 2014 and December 2019 in the radiology archive of our hospital. Subsequently, cases with a history of trauma, abdominal injection, and surgical intervention were excluded from the study. SRSH cases with a history of anticoagulant use and a prolonged international normalized ratio (INR), prolonged clotting time, or prolonged partial thromboplastin time in medical records were evaluated as secondary to anticoagulant use. Complaints of the cases, medications they used, and the difference between the arrival hemoglobin of the cases and the control hemoglobin 1 day later as hemoglobin change were noted. Abdominal CT scans of 24 patients diagnosed as SRSH were evaluated. Subsequently, CT scans were re-evaluated at the radiology workstation by two radiologists experienced in abdominal imaging, unaware of clinical information other than age and gender. The diagnostic decisions are made on consensus. Radiologists evaluated the cases according to the following criteria in CT.

Fluid cellular level (1, Figure 1), and heterogeneity (2, Figure 2) in the hematoma (2), localization at the infra-umbilical level (3) and stranding of subcutaneous fat tissue in the abdominal wall (4), were evaluated as anticoagulant-related rectus sheath hematoma CT findings. Hematoma at supra-umbilical or umbilical level was considered as hematoma unrelated to anticoagulant use. The cases were divided into two groups as anticoagulant-related rectus sheath hematoma (ARH), group 1, and non-anticoagulant-related rectus sheath hematoma (NARH), group 2, according to the results of international normalized ratio (INR). Then, sensitivity and specificity were determined by comparing the accuracy of the diagnoses with the laboratory results. In CT examinations, axial images of 5mm thickness were used (64-slice Aquilion, Toshiba, Japan). Intravenous contrast medium was used except for 4 cases.

Figure 1. Hematoma in the right rectus muscle on contrast-enhanced abdominal CT of a 91-year-old female patient using warfarin for mitral valve replacement. Also, fluid cellular levels (arrow) and contrast extravasation suggesting active bleeding (hollow arrow) are present

For statistical analysis, SPSS Statistics Software v.21.0 (IBM Corp. Release 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY.) was used. Categorical data were expressed as numbers and percentages; Categorical variables were compared with the chi-square test and numerical values with Mann–Whitney U test. $P<0.05$ was considered statistically significant.

Figure 2. Heterogeneous hematoma (arrow) in the right rectus muscle and stranding in the subcutaneous fatty tissue (hollow arrow) at a 71-year-old female patient using warfarin due to pulmonary embolism

4. RESULTS

A total number of 24 patients diagnosed with rectus sheath bleeding, 17 were female and seven were male. Five of the cases were receiving anticoagulant treatment (warfarin) for atrial fibrillation, four for heart valve replacement, three for DVT, one for pulmonary embolism and one for myocardial infarction. In the NARH group, cough

was present in six cases, and no cause was found in four cases. No cases were pregnant. The mean age of the patients was 72.08±10.81 years, and the age range was 47-91 years. 17 of the cases (70.8) were female and the female-male ratio was 2.43 to 1. The mean age of ARH group (Group 1) was 74.50 and the NARH group (Group 2) was 68.70. 79.2% of the cases presented with complaints of abdominal pain and 58.3% with palpable mass. The INR range was between 0.92 and 7.9. The Hb change was 0.2-3.3 g/dl. Hb decrease was more prominent in cases using anticoagulants (p=0.018). The comparison of group 1 and group 2 are given in Table 1.

Table 1. Comparison of groups with and without coagulopathy

	Group 1 (N=14) (ARH)	Group 2 (N=10) (NARH)	p
INR (mean)	3.05	1.07	
Age (mean±SD)	74.50±5.60	68.70±15	0.334
Gender (Female)	10(71.4%)	7 (57%)	0.643
Hb change(mg/dl)	1.62	0.90	0.018
Sup. rectus hematoma N (%)	0 (0%)	6 (60%)	0.001
Inf. rectus hematoma N (%)	9 (64.3%)	1 (10%)	0.001
Sup. and inf. rectus hematoma N (%)	5 (35.7%)	3 (30%)	0.56
Subcutaneous stranding N (%)	13 (92.9%)	2 (20%)	<0.001
Fluid cellular levels N (%)	2 (14.3%)	1 (10%)	0.629
Heterogeneity N (%)	11 (78.6%)	3 (30%)	0.035

N : Number
ARH : Anticoagulant-related rectus sheath hematoma
NARH: Non-anticoagulant-related rectus sheath hematoma
P : Significant
INR : International Normalized Ratio
SS : Standard deviation
Hb : Hemoglobin
sup.: superior
Inf.: inferior

Group 1 had hematomas in the right rectus muscle in six cases, left rectus muscle in seven cases, and bilateral rectus muscles in one case. Group 2 had hematomas in the right rectus muscle in nine cases and left rectus muscle in one case. While only in one case with bilateral rectus muscle hematomas INR was 7.9, the highest INR value was 3.79 in the other cases. While RSH was isolated in 23 cases, one case with coagulation disorder also had hematoma extending into the intra-abdominal area in the pelvic region. In group 2, a hematoma is mostly seen isolated in the umbilical and supraumbilical levels of the rectus muscle but rectus hematoma due to coagulation disorder is mostly seen at the infra-umbilical level (p=0.001). Stranding in subcutaneous fatty tissue accompanying rectus hematoma is mostly seen in patients with coagulopathy (p<0.001). There was contrast extravasation in three cases. These three cases were treated surgically, while the other cases were treated conservatively. There were fluid cellular levels in two cases in group 1 and one case in group 2. The heterogeneous appearance of hematoma is more common in group 1 (p=0.035).

5. DISCUSSION

SRSH is more common in women. This finding is compatible with the previous studies [5 and 6]. SRSH probably increases with the use of anticoagulants by aging. However, in the NARH group, the older age of the cases may be related to the thinning of the rectus abdominis muscles and the decrease in resistance to stress with aging as in cough and eventually causing bleeding. Previous studies have reported

that harmless traumas (innocuous trauma), possibly ignored by patients, lead to SRSH [6 and 7].

SRSH only at the infra-umbilical level or hematoma extending from supraumbilical to the infra-umbilical level in cases with coagulopathy may contribute to the differential diagnosis. There was no patient with only supra-umbilical hematoma in group 1. Stranding in the subcutaneous fat tissue significantly increased in group 1 cases ($p<0.001$). This finding may be related to microhemorrhage foci that occur in the subcutaneous fatty tissue.

The Hb decrease in ARH cases is significantly higher than in NARH cases ($p=0.018$). Although the muscle aponeuroses surrounding the rectus sheath limits bleeding [8], the amount of bleeding is increased in group 1 cases. In this study, the mean INR value was 3.05 and it was not above the target of 2.5-3.5 used in some anticoagulation indications such as mitral valve replacement [9]. Surgical treatment had applied in all three cases with contrast material extravasation on CT. Of these three cases, two had coagulopathy and one was in the other group. Contrast material extravasation in CT is an important finding showing the chance of success of the conservative treatment is low [5]. Fluid cellular levels which were first reported by Swensen et al [3], in extracranial hemorrhages were detected in three cases [3]. In that study, fluid cellular levels and inhomogeneity features were two times more common in hematomas secondary to anticoagulant use. In this study, fluid cellular levels were observed in two cases in group 1 and one case in group 2. It is shown that fluid cellular levels are common in those with coagulopathy [3 and 4]. It is reported that the heterogeneous appearance in hematomas on computed tomography is much more in patients with coagulopathy [3]. In the current study, the frequency of heterogeneity in hematomas has increased in patients using anticoagulants ($p=0.035$). The limitation of this study is the small sample size and because of the retrospective design, the patients cannot be questioned in detail about the trauma history.

6. CONCLUSION AND SUGGESTIONS

In spontaneous rectus hematomas accompanied by coagulability, the hematoma is mostly localized at the infra-umbilical level. Also, subcutaneous fatty tissue stranding is more common. Computed tomography provides useful information in predicting whether SRSH is caused by coagulopathy or not. However, this needs to be confirmed by studies with more cases.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

FINANCIAL DISCLOSURE

The authors declare that this study has received no financial support.

ETHICAL COMMITTEE APPROVAL

Ethics approval was obtained from Adıyaman University Non-Interventional Clinical Research Ethics Board with the number of 2019/9-26.

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