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Case Report

Massive Acute Spinal Subdural Hematoma Causing Sudden Onset Paraplegia in a Patient on Anticoagulation

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Spinal subdural hematoma (SSDH) is a rare but known entity that can cause severe and irreversible motor, sensory, and autonomic dysfunction if not decompressed in a timely manner [1–4]. We report here a case of a massive thoracolumbar SSDH in the setting of therapeutic anticoagulation causing acute-onset paralysis.

1. Introduction

Spinal subdural hematoma (SSDH) is a rare but known entity that can cause severe and irreversible sensorimotor and autonomic dysfunction if not decompressed in a timely manner [1–4]. We report here a case of a massive thoracolumbar SSDH in the setting of therapeutic anticoagulation causing acute-onset paralysis.

2. Literature Search

A literature search was performed to determine if SSDHs of this size and severity of symptoms were reported elsewhere. We searched PubMed using the terms “spinal subdural hematoma,” “massive spinal subdural hematoma,” “acute spinal subdural hematoma,” with the qualified “AND anticoagulation,” “AND warfarin,” “AND heparin,” “AND aspirin,” “AND apixaban,” “AND rivaroxaban,” “AND dabigatran,” with article-type filters for case reports, clinical studies, clinical trials, comparative studies, observational studies, reviews, and systematic reviews. We also performed reviews of citations within articles we found. Our initial search yielded 1,066 articles. After filtering for atraumatic or nonprocedural SSDH, we found 202 articles. Those that did not reference an anticoagulant in the title or body of the article were excluded, leaving a total of 24 articles.

3. Case Report

We present here a 74-year-old female on anticoagulation who developed sudden onset back pain with rapidly progressive paraplegia. On neurologic exam, she was completely flaccid in the bilateral lower extremities with absent sensation from the umbilicus down. Imaging demonstrated a massive extra-axial spinal hematoma from T12 to S1 that initially was believed to be epidural in origin. She was taken emergently to the operating room for a T11-L5 decompressive laminectomy, and dural opening demonstrated a thick subdural clot encasing the conus and cauda equina confirming the subdural pathology. Despite decompression and partial evacuation of the subdural hematoma, she did not recover neurologic function.

4. Operation

A T11-L5 laminectomy was performed for complete epidural decompression. Dural opening demonstrated a thick subdural clot encasing the conus and cauda equina (Figure 2).
A partial evacuation was performed focusing on the proximal hematoma at the spinal cord and conus; the rest of the clot distal at the cauda equina was partially removed with a combination of direct evacuation and irrigation due to the difficult consistency of the clot encasing the cauda equina roots.

5. Postoperative Course

Postoperatively, she did not have any recovery of strength or sensation. She was monitored as an inpatient for 3 days and subsequently discharged to an acute rehabilitation center. At six months follow-up, there has been no recovery of neurologic function.

6. Literature Review Results

Our review of the literature resulted in 202 articles discussing atraumatic and nonprocedural iatrogenic SSDH. They included case reports, reviews on management of SSDH, and reviews on imaging diagnosis of SSDH. We found 24 case reports on SSDH in patients who had been anticoagu-lated (Table 1). There was an even distribution of male and female patients (12 males and 12 females) found in this literature review, and the average age was 63.06 years with a range of 38 to 80 years old (Table 2). The majority of patients in the series had atrial fibrillation as a comorbidity (15/24), with others including stroke (2/24), cardiovascular and disease (3/24), venous thromboembolism (2/24), cardiac valve replacement (2/24), and other (1/24). 2/24 were on low molecular weight heparin (LMWH), 4/24 were on aspirin (in combination therapies), 10/24 were on warfarin, 2/24 were on clopidogrel, 1/24 was on ticlodipine, 3/24 were on apixaban, 4/24 were on rivaroxaban, and 1/24 was on dabigatran. 13/24 patients had multilevel or diffuse SSDH, 9/24 were confined to the thoracic region and 1/24 to the lumbar region, and none had purely cervical or sacral SSDH. 19/24 had no associated subarachnoid hemorrhage (SAH), 4/24 had definite SAH, and 1/24 had indeterminate SAH. 5/24 patients did not improve, 13/24 partially improved, 5/24 fully recovered, and 1 patient died of a cardiac arrest. 16/24 patients received operative intervention, and 8/24 received conservative treatment (including the patient that died). Of the patients that did not improve, all 5 underwent surgical intervention. 10/13 in the partial improvement had surgery compared to 3/13 who were managed conservatively. 4/5 patients who fully recovered were managed conservatively, and 1/5 who died was operated on.

7. Discussion

We present the case of a massive spinal subdural hematoma in an elderly female on anticoagulation causing severe back pain and rapid-onset paraplegia. SSDH as an entity has been previously described, including in association with anticoagulation. We report here a unique case of a massive thoraco-lumbar SSDH that initially was believed on radiological review to be a ventral epidural hematoma in origin.

Spontaneous spinal subdural hematoma (sSSDH) is a rare cause of back pain, paraplegia, and cauda equina syndrome and should be considered in a patient who is on anticoagulation, and no other precipitating events are identified [3]. The average age of patients in this case series was 63.06 years (note—one study simply reported the age as “middle aged”), which is similar to a recent study by Pereira et al. but differs from other older studies [3, 4]. We found an even distribution of males (50%) and females (50%) in this case series, which is similar to previously reported rates [1, 4]. The majority of patients in this series were on warfarin [5–14], which could be due to a higher rate or longer duration of warfarin use compared to newer novel oral anticoagulants (NOACs) and not necessarily due to the agent itself, though studies have shown lower rates of (unspecified) major bleeding events with NOACs [15–23]. We identified fewer patients on other agents (including antiplatelet therapies) that developed SSDH [14, 24–28].

SSDHs are often associated with coagulopathies (iatrogenic or related to impaired innate hemostasis mechanisms) and procedural iatrogenic causes, though there is still a significant amount of SSDHs secondary to arteriovenous malformations, trauma, and idiopathic causes [3, 4, 6]. The pathophysiology
of spontaneous SSDH is still unclear but is theorized to be caused by bleeding within the subdural space itself or as an extension of a subarachnoid bleed into the subdural space after an increase in intrathoracic or intra-abdominal pressure [1, 3]. Indeed, there have been cases of concomitant SAH and SSDH [7, 9, 14, 18, 21]. Important prognostic factors include neurologic status at presentation, presence of coagulopathy, performance of lumbar puncture, and associated diseases [4]. Interestingly, extension of hematoma, surgery, and presence of SAH were not found to be significant predictors of outcome.

**Figure 2:** Operative microscope views of the dorsal thoracolumbar spinal dura. Note the mottled appearance of the dural sac (a). Opening of the dural sac (b, c) demonstrates thick clotted blood intradurally. The massive volume of the subdural blood has filled the intradural space and obliterated all egress of cerebrospinal fluid (d).

**Table 1:** Results and summary of the case reports identified in the literature search.

| Patient characteristics | Male | Female |
|-------------------------|------|--------|
| Sex                     | 12   | 12     |
| Average Age             | 63.06| 38     |
| Minimum Age             | 38   |        |
| Maximum Age             | 80   |        |
| Comorbidities           |      |        |
| A-fib                   | 15   | 2      |
| Stroke                  | 2    | 3      |
| CVD                     | 3    | 2      |
| PE/DVT                  | 2    | 10     |
| Clopidogrel             | 2    |        |
| Ticlodipine             | 2    |        |
| Apixaban                | 1    |        |
| Rivaroxaban             | 3    |        |
| Dabigatran              | 4    | 1      |
| Agent used              | LMWH| ASA    |
| Warfarin                |      | 10     |
| Clopidogrel             | 2    |        |
| Ticlodipine             | 2    |        |
| Apixaban                | 1    |        |
| Rivaroxaban             | 3    |        |
| Dabigatran              | 4    | 1      |
| Location of bleed       | Cervical | Thoracic |
| Lumbar                  | 0    | 9      |
| Sacral                  | 1    | 1      |
| Multilevel              | 13   |        |
| Associated SAH          | Yes | No     |
| Indeterminate           | 19   | 4      |
| Intervention            | Operative | Nonoperative |
| No improvement          | 16   | 8      |
| Some improvement        |      |        |
| Full recovery           | 5    | 1      |
| Death                   | 13   |        |
| Recovery                |      |        |
| No improvement          |      |        |
| Some improvement        | 5    | 10     |
| Full recovery           | 3    |        |
| Death                   |      |        |
| Recovery vs. intervention| Op  | Non-Op |
| No improvement          | 5    | 0      |
| Some improvement        |      |        |
| Full recovery           | 3    | 4      |
| Death                   |      |        |
| Author and year | Age (years) | Sex | Location | Presenting symptoms | Anticoagulant/antiplatelet | Risk factors | SAH | Treatment | Outcome |
|-----------------|-------------|-----|----------|---------------------|---------------------------|--------------|-----|-----------|---------|
| Miller 2004     | 67          | M   | T11-S1   | Progressive loss of sensation, bilateral leg weakness, back pain, urinary retention | Warfarin       | Atrial fibrillation | None | T10-L2 laminectomy | No recovery |
| Cha 2005        | 72          | F   | T3-T6    | Bilateral lower extremity paraplegia, sensory loss, urinary retention, back pain | LMWH, ASA      | Laryngeal cancer, NSTEMI | None | T3-T5 laminectomy | Minimal recovery |
| Chau 2008       | 52          | M   | C7-L1    | Bilateral lower limb weakness, decreased lower extremity sensation, bowel and bladder dysfunction | LMWH          | Salmonella typhi, reactive arthritis, type II diabetes | None | T11-T12 laminectomy | Partial recovery |
| Badge 2009      | 78          | F   | T3-T12   | Nausea, giddiness, headache, back pain, progressive L lower extremity weakness and ataxia | Warfarin       | Atrial fibrillation | None | T5 laminectomy | Improved |
| Mete 2010       | 42          | M   | T6-L5    | Sudden headache and backache, agitation, paraparesis, meningismus | Warfarin       | Cardiac pacemaker, h/o cardiac bypass | Yes | Conservative | Death (cardiac arrest) |
| Payer 2010      | 59          | M   | T2-T9    | Left-dominant paraparesis below T8, weakness, sphincter dysfunction | ASA, clopidogrel | Cardiac stenting | None | Conservative | Full strength recovery at 1 year, improvement in ataxia, paresthesia, urge incontinence |
| Wang 2012       | 67          | F   | L4-S1    | Back pain, bilateral radiating leg pain, bifrontotemporal headache, bilateral lower extremity weakness and numbness | ASA, clopidogrel | Atrial fibrillation, concomitant SDH | None | Conservative (SSDH), burr hole craniotomy (SDH) | Full recovery at 1 year |
| Bruce-Brand 2013| 76          | M   | L1-L4    | Sudden onset severe low back pain, lower extremity weakness | Warfarin       | Atrial fibrillation, type II diabetes, HTN, dyslipidemia | None | T12-L4 laminectomy | Partial recovery at 6 months |
| Castillo 2015   | 69          | M   | T3-conus | Back pain, bilateral lower extremity paraplegia, bowel and bladder dysfunction | Rivaroxaban    | Atrial fibrillation | None | Cervical and lumbar drains | No recovery at 6 months |
| Dargazanli 2015 | 72          | M   | T6-T8    | Interscapular back pain, rapidly progressive bilateral lower extremity paraplegia, decreased lower extremity sensation to pain and temperature L > R | Rivaroxaban    | Atrial fibrillation | None | T6-T8 laminectomy | No improvement at 6 months |
| Frioui 2015     | 65          | F   | T12-L1   | Back pain, paraparesis, urinary retention | Undear anticoagulant | Atrial fibrillation, HTN | None | Conservative | Neurological recovery observed at 24 h. Persistent |
| Author and year | Age (years) | Sex | Location | Presenting symptoms | Anticoagulant/antiplatelet | Risk factors | SAH | Treatment | Outcome |
|-----------------|-------------|-----|----------|---------------------|---------------------------|--------------|-----|-----------|---------|
| Jung 2015       | 53          | F   | C7-T6    | Sudden onset headache, nausea, vomiting, meningismus, bilateral lower extremity sensory loss and weakness, back pain | Warfarin       | Aortic valve replacement | Yes | C7-T6 laminectomy | Improvement in anal tone and bladder function |
| Zaarour 2015    | 58          | M   | C7-T2    | Interscapular back pain, progressive bilateral lower extremity weakness and numbness | Rivaroxaban    | Atrial fibrillation, type II diabetes, HTN, dyslipidemia, recent THA with spinal anesthesia | None | Initially conservative, C7 corpectomy at HD4 | Improved |
| Siasios 2016    | 38          | F   | Diffuse  | Severe neck and back pain | Warfarin       | Recent C-section, PE | None | Conservative | Full recovery at discharge |
| Wolfe 2017      | 67          | M   | Cervicothoracic | Left lower extremity weakness, urinary retention | Dabigatran     | Atrial fibrillation, endocarditis, PCKD s/p transplant, BPH, OSA, melanoma | Yes | Conservative | Full recovery in 2 days |
| Akiyama 2017    | 71          | M   | T7-S1    | 2 weeks history bilateral lower leg pain, dysesthesia, paraparesis, urinary disturbance, and fever | Ticlidipine    | L cerebral infarct, unruptured L MCA aneurysms | None | L3-L4 laminectomy | Improved |
| Bunevicius 2017 | 68          | M   | T2-T6    | Left-sided chest and back pain, L leg weakness, and R leg numbness | Warfarin       | Atrial fibrillation | None | T3-T6 hemilaminectomy | Partial improvement |
| Bang 2018       | Middle aged | F   | Thoracolumbar | Lower extremity weakness after assault** | Rivaroxaban    | Atrial fibrillation, HTN | None | Laminectomy | Improved at 6 months |
| Colell 2018     | 75          | F   | Diffuse  | Bilateral lower extremity weakness L > R, decreased sensation | Apixaban       | Atrial fibrillation, HTN | None | Laminectomy | Improved at 6 months |
| Girithari 2018  | 57          | F   | T4-T8    | Back pain, headache, vomiting, bilateral lower extremity weakness, urinary retention | Warfarin       | DVT | None | Laminectomy | No improvement at 6 months |
| Mchaourab 2018  | 68          | M   | T1-T5    | Back pain, urinary retention, headache, neck stiffness, vomiting, bilateral limb weakness, and ataxia | Apixaban       | Atrial fibrillation | Possible | Conservative | Partial improvement |
| Arain 2019      | 80          | F   | T4-T9    | Bilateral lower extremity paraplegia, incontinence | Warfarin       | Atrial fibrillation | None | T3-T11 laminectomy | Partial improvement |
| Ardebol 2019    | 67          | F   | T4-T7    | Back pain, progressive bilateral lower extremity paraplegia, bowel and bladder dysfunction | Apixaban       | Atrial fibrillation | None | T4-T7 laminectomy | Full recovery at 1 year |
| Weiner 2019     | 42          | F   | L1-S1    | Vaginal pain, back pain radiating down the right leg, left leg weakness, frontal headache | Warfarin, ASA  | Rheumatic heart disease, mechanical mitral valve, CVA, | Yes | Craniotomy for SDH | Full recovery at 1 month |
| Author and year | Age (years) | Sex | Location | Presenting symptoms | Anticoagulant/antiplatelet | Risk factors | SAH | Treatment | Outcome |
|----------------|-------------|-----|----------|---------------------|----------------------------|--------------|-----|-----------|---------|
|                |             |     |          |                     | concomitant SDH, concomitant arachnoiditis | conservative for SSDH |     |           |         |
MRI is considered the gold standard in the diagnosis of SSDH, but digital subtraction angiography may be useful if spinal AVM is suspected [2]. SSDH can be managed conservatively with medical management (often including steroids), percutaneous drainage, and surgical evacuation [3, 29]. Though the literature suggests that conservative management results in better outcomes, this may be related to bias in choosing patients with less severe symptoms for medical management whereas more impaired patients are selected for surgical intervention [4].

8. Conclusion

SSDH is a rare but serious cause of rapid-onset back pain, sensorimotor, and autonomic deficits, and in some cases, mortality. It is often associated with iatrogenic causes including anticoagulation (as in this case) but in some instances may be idiopathic. MRI is the gold standard for diagnosis. Patients with mild or moderate symptoms can be managed conservatively, but urgent surgical decompression and clot evacuation are warranted in patients with severe symptoms to prevent permanent neurologic injury or death.

Data Availability

The imaging and photographic data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors’ Contributions

J. Kosarchuk contributed to the writing, editing, and study design. C. Lewis contributed to the writing and editing. M. Pham contributed to the editing, supervision, acquisition of the data, and study concept.

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