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Contribution of Multidetector CT in the Diagnosis and Management of Extradural Hematomas

Z. Ait Said[1*], FZ Hanine[1], A. EL Mehdi[1], A. Mouhsine[1], A. Akhadar[1]

[1]Department of Radiology, Avicenne Military Hospital, Marrakech, Morocco

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***Corresponding author:** Z. Ait Said
Department of Radiology, Avicenne Military Hospital, Marrakech, Morocco

Abstract **Original Research Article**

The intracranial extradural hematoma is a blood collection formed between the dura mater and the bony internal table of the skull. It is a therapeutic emergency requiring rapid management, as it involves the vital prognosis. Our retrospective study focuses on 25 cases of HED in the Neurosurgery Department of the Military Hospital Avicenna of Marrakech, over a period of 5 years (from January 01, 2015 to December 31, 2019). The average age of patients was 30.96 years, with a clear male predominance (96%). Road accidents were the most common cause (76.92%). Initial unconsciousness was observed in 96% of cases. Clinically, the state of consciousness was generally good in 72% of cases, and only 8% of cases were severe head injuries with GCS ≤ 8. In all cases, the diagnosis of HED was made by brain computed tomography. It made it possible to make the positive diagnosis and to specify the location, the appearance, the volume and the thickness of the HED and a possible effect of mass exerted by the hematoma on the cerebral parenchyma. On the brain scan, frontal localization was most common (32%), followed by temporal (20%). The appearance was hyperdense in biconvex lens for all patients. The mass effect was present in 20% of cases (5 patients). The treatment of HED is a neurosurgical emergency. Surgical treatment was performed in 56% of patients (14 cases), while 44% of patients (11 cases) were monitored and medically treated without surgery. The evolution was good in 84% of cases. Only one patient died due to a sudden neurological aggravation followed by cardio-respiratory arrest.

Keywords: Computed Tomography (CT), Extradural Hematoma (EDH), Imaging.

INTRODUCTION

Intracranial extradural hematoma is a blood collection located between the dura mater and the inner table of the skull [1]. It is a rare but serious condition, as it rapidly threatens the patient's life. It constitutes a therapeutic emergency and therefore requires prompt management [2]. Its classic clinical presentation is characterized by an initial loss of consciousness, followed by a return to a normal state of consciousness (lucid interval), and subsequently the onset of neurological signs with deterioration of consciousness [3]. CT scanning is the only examination that can provide, in an emergency setting, both an assessment of the lesions and a topographic diagnosis [1]. Surgical intervention for extradural hematoma is a major emergency, and the benefit of urgent surgical treatment is well established [4]. Medicalized transport and cranial computed tomography have greatly contributed to the rapidity of diagnosis and, consequently, to the quality of treatment for these patients [1]. The prognosis of EDH was formerly determined exclusively by the timing of surgical intervention for an apparently isolated hematoma; nowadays, it depends on the speed and coordination of the entire medico-surgical management chain, including transportation resources, resuscitation, modern imaging, and the availability of neurosurgical facilities [5, 6].

METHODS

This is a retrospective study covering a 5-year period from January 1, 2015, to December 31, 2019, involving 25 patient records with confirmed extradural hematoma on brain CT scan, managed at the Neurosurgery Department of the Avicenne Military Hospital in Marrakech. All patients presented with intracranial EDH (unilateral or bilateral) confirmed by paraclinical investigations, particularly brain CT scan, and were managed by the Neurosurgery Department of the Avicenne Military Hospital in Marrakech.

This study is a synthesis work based on data collected from medical records stored in the archives of the Neurosurgery Department at the Avicenne Military Hospital in Marrakech. These records were analyzed to

their full extent using a data extraction form. Epidemiological, clinical, paraclinical (imaging), therapeutic, and outcome data were taken into consideration.

The collected data were processed using Microsoft Office Excel to illustrate the results and facilitate their interpretation. The results were expressed as percentages, presented in the form of graphs or tables.

RESULTS

were managed by the Neurosurgery Department of the Avicenne Military Hospital in Marrakech, all of whom underwent a brain CT scan. The annual average was five patients, with a peak of nine cases in 2018. Patient ages ranged from 14 to 62 years, with a mean age of 30.96 years, and a marked male predominance (24 men and 1 woman). The injuries were mainly due to road traffic accidents (76.92%), followed by falls (19.23%) and assaults (3.85%). The average length of hospital stay in the neurosurgery department was 6.84 days. All patients were admitted through the emergency department, 56% required intensive care, and 52% were transferred from another city. The admission delay was less than six hours for 11 patients, longer for one patient, and variable for the others.

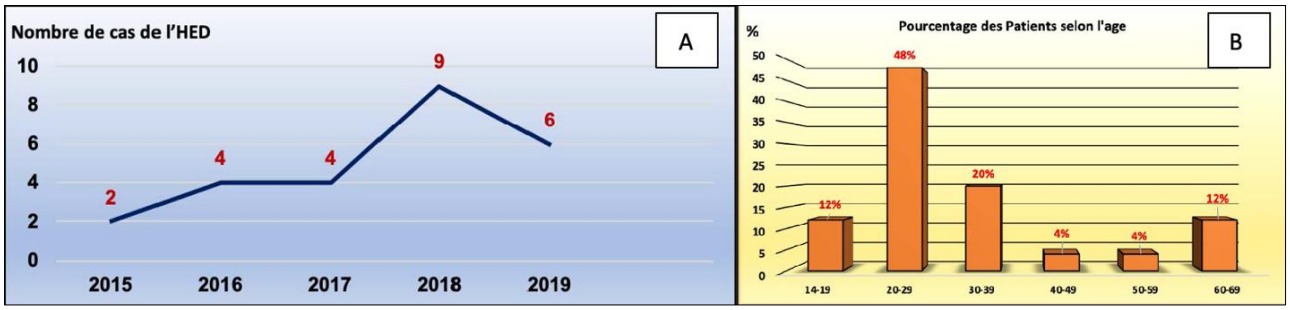

Figure 1: Annual distribution of EDH cases who underwent a CT scan (A) and distribution of patients by age groups (B)

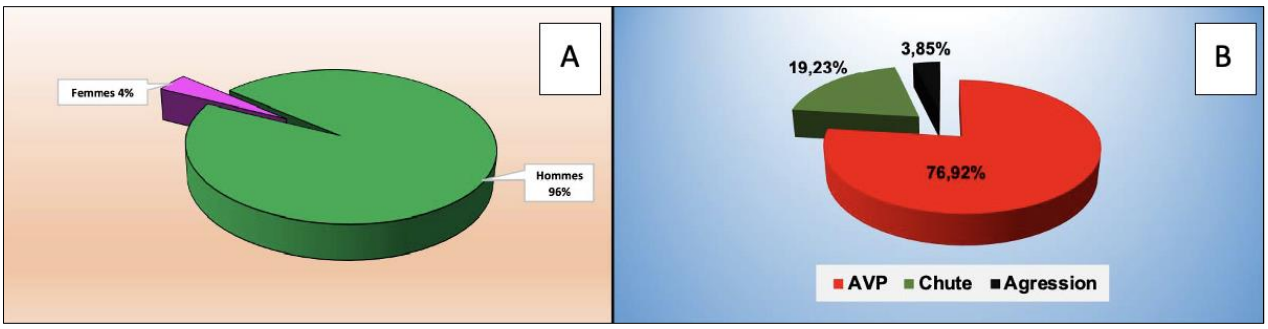

Figure 2: Distribution by sex (A) and by etiology (B)

Clinically, 80% of the cases had no notable medical history. One patient had previously undergone surgery for EDH, 4% had diabetes and hypertension, and 8% were smokers. Initial loss of consciousness was observed in 96% of cases. Upon admission, all patients were hemodynamically stable. The Glasgow Coma Scale ranged from 13 to 15 in 72% of cases, from 9 to 12 in 20%, and ≤8 in 8%. Neurological deficits were noted in 16% of cases, including hemiparesis, seizures, and anisocoria. Scalp injuries were common, present in 56% of cases.

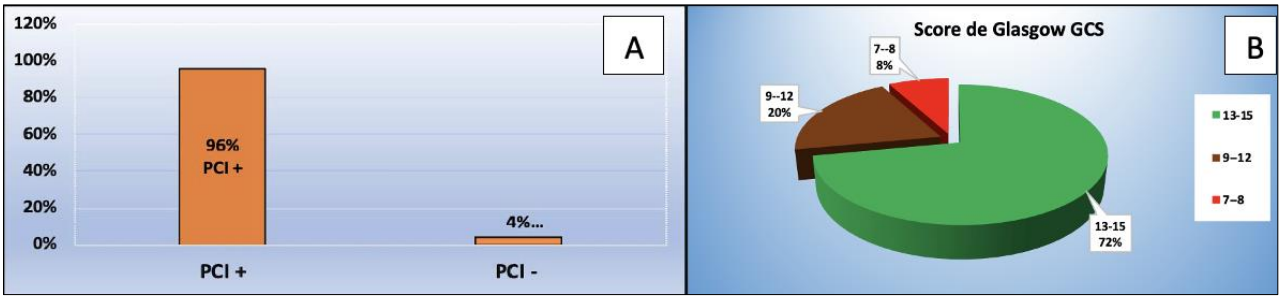

Figure 3: Distribution by presence or absence of TBI (A) and GCS values according to the number of cases (B)

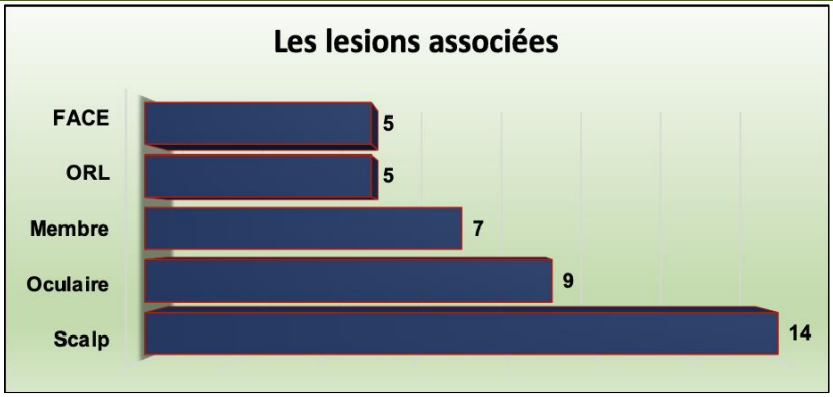

Figure 4: Distribution according to associated injuries

Cerebral computed tomography was performed for all patients, with an average of 2.28 scans per case. Cranial fractures were present in 72% of cases. EDH localization was frontal in 32%, temporal in 20%, fronto-temporo-parietal and temporo-parietal in 16% each, and occipital in 4%. EDHs were unilateral in 96% of cases, predominantly on the right side. EDH thickness was less than 10 mm in 44% of cases, and a mass effect was noted in 20%. Associated cranioencephalic injuries were observed, including contusions (11 cases) and meningeal hemorrhages (6 cases). Additional examinations, including chest, limb, and cervical spine X-rays as well as cervical CT, were performed as needed.

Table 1: Distribution according to the side of the EDH

Coté de l'HED	Nombre	%
Droit	14	56 %
Gauche	10	40 %
Bilatéral	1	4%
Total	**25**	**100**

Table 2: Distribution according to EDH location

Localisation de l'HED	Nombre	%
Frontale	8	32 %
Temporale	5	20 %
Pariétale	3	12 %
Occipitale	1	4 %
Temporo-pariétale	4	16 %
Fronto-temporo-pariétale	4	16 %
Total	**25**	**100 %**

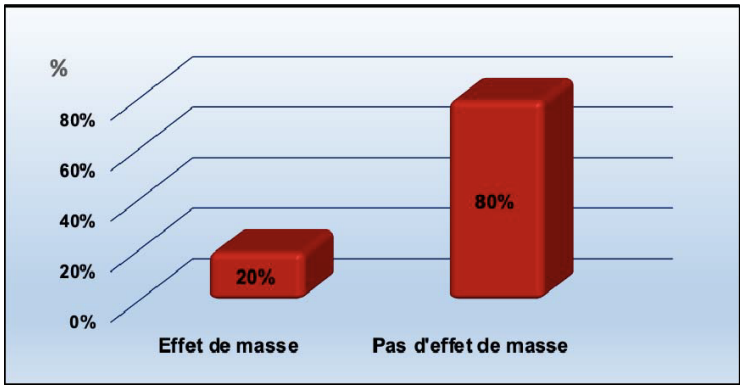

Figure 5: Distribution according to the mass effect of the EDH

Treatment was surgical in 56% of cases and medical in 44%. Craniotomy with a bone flap was the most commonly used technique (78.6% of cases), with an average operative time of 2 hours and 25 minutes.

Bleeding was primarily arterial in origin (35.71%). All patients received concomitant medical treatment, and motor rehabilitation was provided for neurological deficits to restore autonomy.

Post-hospital outcomes were generally favorable. Surgically treated patients were transferred to intensive care and extubated, showing clinical improvement in all except one patient who died on the second postoperative day. Medically managed patients also had favorable outcomes, although two required secondary surgical intervention due to neurological deterioration and increased EDH on follow-up CT. Outpatient follow-up revealed that six patients were lost to follow-up, while five showed progressive clinical improvement and resolution of the EDH on control CT. Minor postoperative complications were noted, including one local infection related to inadequate care.

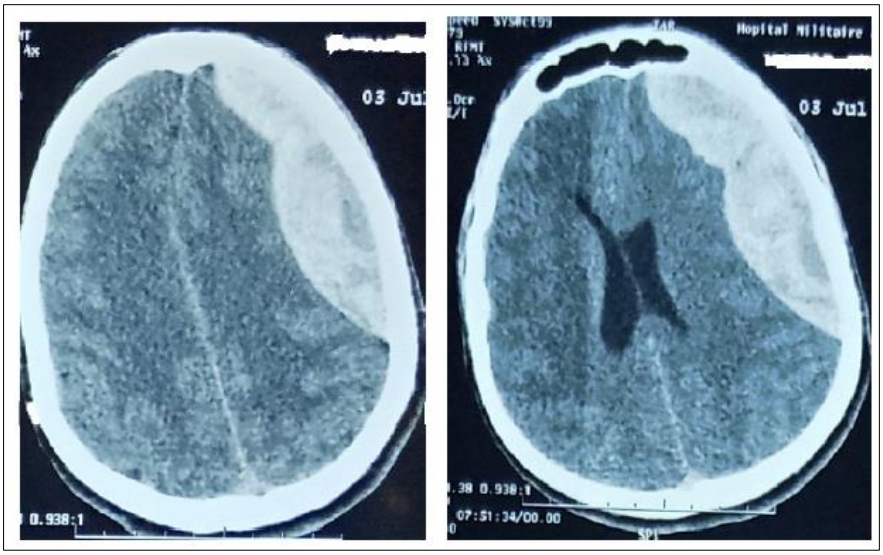

Figure 6: Large left fronto-temporo-parietal EDH, spontaneously heterogeneous hyperdense, exerting a mass effect on the midline (axial view)

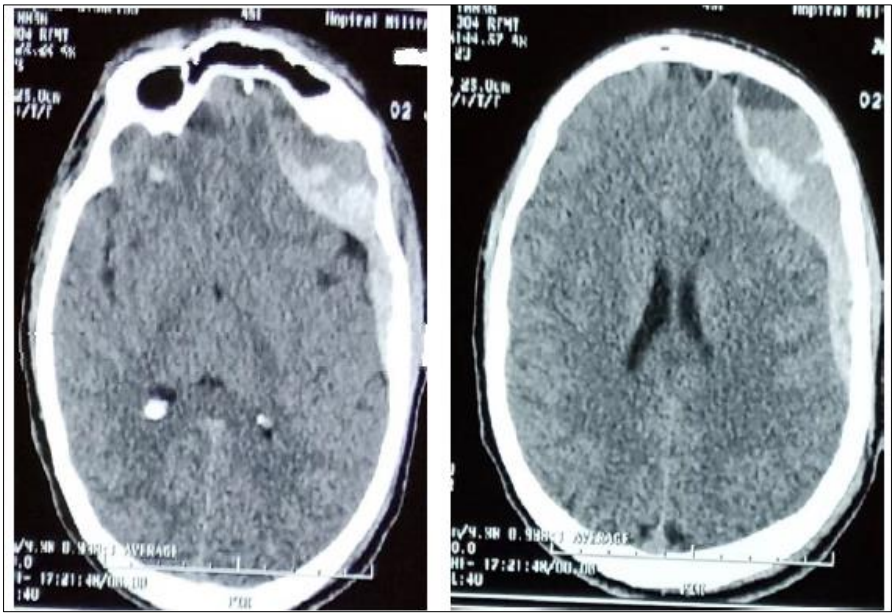

Figure 7: Cerebral CT of the same patient showing the evolution of the EDH with a depressed fracture corresponding to the left frontal EDH

DISCUSSION

Extradural hematoma is an increasingly reported condition in developing countries, primarily affecting young adults aged 20 to 29, with a male predominance [3]. Road traffic accidents are the most frequent cause, followed by falls and assaults [2], consistent with the findings of our series. Clinically, initial loss of consciousness is common [7], and although motor deficits and pupillary abnormalities are generally less frequent [8], our study observed comparable proportions. Associated injuries, notably scalp lacerations and limb trauma [9], also align with the

literature. EDH accounts for 1–3% of all head injuries and 9–20% of severe cranial trauma [1], figures that are in agreement with our experience.

The radiological diagnosis of epidural hematoma relies primarily on computed tomography, a rapid, reliable, and easily performed examination in the trauma setting [10]. CT allows confirmation of the EDH, assessment of its volume, thickness, and mass effect, as well as identification of cranial fractures and associated intracranial injuries [1], thereby guiding surgical decision-making. In our series, all patients underwent cerebral CT, identifying 25 EDHs, with cranial fractures found in 72% of cases, predominantly frontal, consistent with the literature [11, 9]. Unilateral EDHs predominated (96%), with a slight right-sided dominance (56%), similar to published data [2-13]. EDHs were mainly located in the frontal and temporal regions, in accordance with the described pathophysiology related to the thin temporal bone and the caliber of the middle meningeal arteries [1-6].

Radiological appearance of EDHs varies with age: acute and subacute forms are usually arterial, whereas chronic forms are often venous [1-3]. Mixed or heterogeneous density hematomas, indicating active bleeding, are associated with a less favorable prognosis [14]. In our series, mass effect and midline shift were present in 20% of patients, slightly lower than percentages reported by other authors [3-11]. CT also allowed detection of associated intracranial lesions, predominantly contusions (44%), reflecting the severity of the observed trauma, which aligns with some series but differs from studies where edema predominates [3-9]. MRI remains useful for exploring structures poorly visualized on CT and occult or remote lesions, while angiography, once essential [15], has been largely replaced by CT. Overall, our study confirms the central role of CT in the diagnosis, therapeutic planning, and follow-up of EDHs, with results comparable to those in the literature.

The management of extradural hematoma (EDH) is based on clinical and radiological assessment, guiding the choice between surgical and conservative treatment. Surgical intervention aims to relieve compression, stop bleeding, and prevent recurrence, using craniotomy, bone flap, or burr hole depending on the location and volume of the EDH. Asymptomatic or small-volume EDHs can be monitored clinically and by CT, with surgical conversion if deterioration occurs. Medical management pre, per, and postoperatively prevents intracranial hypertension and associated complications through ventilation, head elevation, sedation, and osmotherapy [9].

The prognosis of epidural hematomas depends on multiple clinical and radiological factors. It is generally favorable in children and poor in patients over 60 years of age [16]. The Glasgow Coma Scale at admission and the presence of pupillary abnormalities are major prognostic indicators [17]. EDH characteristics, including volume, density, and in some cases location, as well as the presence of other intracranial injuries, significantly increase mortality [5], whereas early management improves clinical outcomes. Postoperative evolution is most often favorable, with neurological, epileptic, or psychoaffective sequelae being rare, particularly when the EDH is isolated [7].

CONCLUSION

Extradural hematoma is a neurosurgical emergency that predominantly affects young men. Clinically, it presents with an initial loss of consciousness, followed by a lucid interval, and then a recurrence of impaired consciousness, sometimes progressing to coma. No clinical sign is pathognomonic, making the diagnosis difficult outside of typical presentations. Brain computed tomography is the reference imaging modality: it classically shows a hyperdense biconvex collection adjacent to the cranial vault, allowing localization of the hematoma, assessment of its thickness, mass effect, associated lesions, and guiding surgical decision-making. Treatment is primarily surgical, although some EDHs can be managed conservatively. The introduction of CT has significantly reduced the mortality associated with this condition.

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