REVIEW

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Current State of Minimal Invasive Surgery for Intracranial Epidural Hematoma

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ABSTRACT

Introduction: Craniotomy and hematoma evacuation is the gold standard of treatment for epidural hematoma (EDH). However, minimal invasive surgery for EDH might come in handy in conjunction or as a standalone therapy for EDH, as some of them might be easier to perform in a dire situation. In this literature review, we aim to review the available literatures regarding minimally invasive surgery for EDH.
Method: This literature review described the available studies about minimal invasive surgery for EDH.
Result: Thirteen studies were identified. The procedures consisted of burrhole-based approach, minicraniotomy, endovascular, and image-guided evacuation. Several of the procedures were performed on hypodense-appearing EDH, some on post-operative EDH, and one on venous-sinus-involving EDH. The majority of studies reported favourable outcome after minimal invasive surgery.
Conclusion: Available literatures showed that most minimal invasive surgery can be performed quickly and is thus suitable for the emergency nature of EDH. Liquified-appearing EDH, post-operative EDH, or EDH situated near the dural venous sinus were among the reasons to pursue minimal invasive EDH evacuation. Minimal invasive surgery for EDH generally resulted in favourable outcome. Larger studies are required to validate the benefit of minimal invasive surgery as a standalone therapy or in combination with standard craniotomy for EDH.

Keywords: *Epidural hematoma, minimal invasive surgery*.
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INTRODUCTION

Epidural hematoma (EDH) is a potentially lethal condition and is considered a true neurosurgical emergency.[1] Craniotomy and hematoma evacuation for lesion which fulfil clinical and CT criteria is the gold standard of treatment.[2] Probably due to the fact that patients with EDH tended to fare excellently after standard craniotomy[3], the development of minimal invasive surgery for this lesion was not considered a priority. However, expanding EDH might rapidly cause brain herniation[4], thus minimal invasive surgery might come in handy in such dire situation as some of them are easier and faster to perform than the standard craniotomy.

METHODS

This literature review aims to describe the currently available options of minimal invasive surgery for EDH and their outcome based on previously published papers. We searched for suitable studies from PubMed, Directory of Open Access Journal (DOAJ), and Google Scholar. Only studies published in English and Bahasa Indonesia would be reviewed. The keywords used for each platforms were as shown on Table 1.

Data that were sought from each papers were (1) age, (2) sex, (3) preoperative GCS, (4) preoperative EDH volume, (5) preoperative midline shift, (6) types of interventions, (7) time to radiologic resolution of the EDH, (8) postoperative GCS, and (9) functional outcome based on GOS or GOS-E. All data were put into narratives and table.

RESULT

Literature search on PubMed, DOAJ, and Google Scholar in combination yield 1715 results, of which only 15 reported experience on minimal invasive surgery in EDH cases. Two papers from China unfortunately had no available full-text, leaving only 13 to be reviewed. Nine of those studies originated from mainland China, one from Taiwan, one from Nigeria, and one from Iran. Only two studies shared a similar procedure (mini craniotomy) while none of the rest reported exactly the same procedure. For the sole purpose of providing an orderly reads, however, we tried to classify the procedures into (1) Burrhole-based procedure, craniotomy, and needle puncture, (2) minicraniotomy, (3) endovascular procedure, and (4) image-guided procedure.

Burrhole-based procedure, craniotomy, and needle puncture

Aspiration and drainage using YL-1 needle

We identified one retrospective study from China which used a drainage system using YL-1 needle on 58 patients with traumatic EDH which straddled the transverse sinus. The authors also administered 50.000 – 60.000 units of urokinase through the needle twice a day. In 42 patients, however, other types of intracranial haemorrhage were also present, namely brain contusion and/or subdural hematoma.

Table 1. Keywords used for the search

Platforms	Keywords Combination
PubMed	((cranial epidural hematoma[MeSH Terms]) OR (cranial extradural hematoma[MeSH Terms]) OR (cranial epidural hemorrhage[MeSH Terms]) OR (cranial extradural hemorrhage[MeSH Terms])) AND Acute AND (Trauma OR Traumatic) AND (Minimally Invasive OR Minimal Invasive) AND (outcome OR Glasgow Outcome Scale OR GOS OR GOS-E)
DOAJ	((epidural hematoma) OR (extradural hematoma) OR (epidural hemorrhage) OR (extradural hemorrhage)) AND Acute AND (Trauma OR Traumatic) AND (Minimally Invasive OR Minimal Invasive) AND Outcome
Google Scholar	((cranial epidural hematoma) OR (cranial extradural hematoma) OR (cranial epidural hemorrhage) OR (cranial extradural hemorrhage)) AND Acute AND (Trauma OR Traumatic) AND (Minimally Invasive OR Minimal Invasive) AND (outcome OR Glasgow Outcome Scale OR GOS

The authors included patients with EDH volume exceeding 30 ml (mean 45 ± 10 ml) with mean pre-operative GCS of 8 ± 1. This procedure successfully drained the hematoma to an average of 20 ± 5 ml and 15 ± 2 ml at 3 hours and 3 days post-operative, respectively. Eight patients deteriorated and eventually underwent hematoma evacuation and decompressive craniectomy. Two out of those eight, however, died after the surgery while another two progressed to vegetative state. Fourty-five (77%) of the remaining 54 patients were reported to have GOS of 5 at 3-month follow-up, while the rest (9; 15%) had GOS of 4.

Burrhole drainage

Three studies which reported the use of burrhole drainage to evacuate EDH were identified.[5–7] Habibi et al. shared their experience in performing burrhole drainage in eight EDH cases with isodense appearance on CT scan. All cases in the study were associated with some form of coagulation abnormalities: one had dysfibrinogenemia, two had haemophilia, one had von Willebrand disease, and the other four had prolonged prothrombin time or bleeding time. The mean age of the patients was 11,75 ± 7,2 year-old while the mean pre-operative GCS was 13,75 ± 0,9. Six of the patients had EDH volume of more than 30 ml, with mean volume and mean midline shift of 43,12 ± 16,9 ml and 5,5 ± 4,6 mm, respectively.[5]

The procedure was a simple burrhole measured at 15 mm in diameter made over the area under which the hematoma was the thickest. A vacuum drainage was then placed over the burrhole to let the hematoma drain. All patients were reported to improve clinically on first post-operative day. Repeat CT scan on third day revealed complete resolution of the hematoma. All patients had favourable GOS although the exact score was not reported and longer follow-up was not pursued.[5]

Han et al. performed burrhole drainage for five cases of iso/hypodense posterior fossa EDH in children. The mean preoperative GCS was 10,8 ± 1,3. Mean preoperative volume was 20,2 ± 2,7 ml. All patients underwent the surgery within first 48 hours since the injury. Repeat CT was performed on average at 22.3 hours after the initial CT and 6 weeks after the injury, yet the results were not disclosed by the authors. At 6-week after injury, however, all patients were neurologically intact.[6]

Ren et al. treated five cases of post-operative EDH by inserting drain tube over a burrhole made during the initial surgery. In one case of post-cranioplasty EDH, the tube was positioned over the titanium mesh instead of over a burrhole. The initial incision was re-opened about 1-2 cm to accommodate the tube's insertion.. This study unfortunately did not report any post-operative CT nor any follow-up.[7]

Burrhole drainage and urokinase instillation

Three studies reported the use of urokinase instillation into the hematoma cavity.[8–10] In a study by Liu et al., a draining tube was inserted through a craniotomy made by a twist-drill. After aspirating a bit of the hematoma, 20 kilounit of urokinase was injected three times a day. Of 21 patients in the study, 13 had pre-operative GCS of > 12, 5 had GCS of 8 – 12, and 3 had GCS lower than 8. The range of EDH volume and midline shift in the study was 22 – 50 ml and < 10 – 15 mm, respectively. Six patients had concomitant SDHs or contusions.

Two patients never regained full consciousness, one patient eventually required craniotomy due to delayed intracerebral hematoma in the posterior fossa, while the other 18 patients were fully conscious when discharged from the hospital. All three patients with unfavourable outcome were said to have concomitant lesions. Data on GOS was only recorded in 17 patients (16 with GOS of 5, 1 with GOS of 4).[8]

Wang et al. did minimal invasive surgery in 59 cases of EDH. The median EDH volume was 45 (13 – 145) ml. Forty-one cases had epidural hematomas accompanied with skull fracture, contusion, and brain laceration; eight cases had concomitant cerebral herniation (including one patient with diffuse axonal injury), and one case also had spinal cord injury.

The procedure consisted of drilling a small hole using manual skull drill to allow the insertion of a 10F tube. The hematoma was initially aspirated and then the drain was fixed in place. Twenty-four hours later the hematoma was rinsed with normal saline and 20.000 – 40.000 unit of urokinase was instilled twice a day. Eight patients with cerebral herniation had the hematoma aspirated prior to craniotomy. EDH was seen resolved on post-operative day 1, 3, 5, and 7 in 8, 3, 17, and 31 patients, respectively. Two patients died due to respiratory failure and cerebral herniation. The majority (55 patients) had Barthel index of > 60, one had Barthel index of 41-60, and one scored ≤ 40.[9]

Shrestha et al. performed burrhole drainage with urokinase instillation on 42 cases of EDH. All patients had pre-operative GCS of greater than 8. Mean EDH volume was 38,5 ± 8,7 ml and mean

Table 2. Summary of all studies

Author and Country	Patients	Radiology	Intervention	Outcome
Lu, 2013[16] China	n= 58 39 M, 19 F Mean Pre-Op GCS 8 ± 1 Mean age 38,6 ± n/a	Traumatic EDH straddling transverse Sinus Mean volume 45 ± 10 ml Mean midline shift N/A	Drainage through YL-1 needle aspiration drainage system Urokinase of 50.000 – 60.000 IU was injected to the hematoma cavity twice a day	**Resolution on CT** 3h post-op: 20 ± 5 ml 3d post-op: 15 ± 2 ml **GCS** 5d post-op 12 ± 1 **Functional Outcome** GOS 3 months - 45 (77%) GOS 5 - 9 (15%) GOS 4
Habibi, 2012[5] Iran	N= 8 5 M, 3 F Mean Pre-Op GCS 13,75 ± 0,9 Mean age 11,75 ± 7,2 y.o All with coagulopathy	Mean volume 43,12 ± 16,9 ml Mean midline shift 5,5 ± 4,6 mm	A single burrhole of 15 mm made on the area under which EDH is the thickest, and then a vacuum drainage is placed over the epidural space	**Resolution on CT** All resolved by day 3 **GCS** Not reported **Functional Outcome** GOS when discharged were 100% favorable
Han, 2018[6] China	N= 5 3 M, 2 F Mean Pre-Op GCS 10,8 ± 1,3 Mean age 4,4 ± 0,5 y.o	Hypodense posterior fossa EDH Mean volume 20,2 ± 2,7 ml Mean midline shift n/a	Burrhole drainage	**Resolution on CT** Repeat CT scan performed but not reported **GCS** Not reported **Functional Outcome** All patients had good outcome GOS not reported
Ren, 2018[7] China	N= 5 4 M, 1 F Mean Pre-Op GCS 8,4 ± 3,5 Mean age 42,8 ± 15,7 y.o	Mean volume 65,32 ± 24,9 ml Midline shift n/a	Post-operative EDH with isodense appearance, occurring after 3,6 ± 0,9 days after initial surgery EDH evacuation by opening the incision of initial procedure about 1-2 cm, and then a drain tube is placed over the burrhole. In one patient with post-cranioplasty EDH, the tube is placed over the titanium mesh	**Resolution on CT** Not reported **GCS** Not reported **Functional Outcome** Not reported

Author and Country	Patients	Radiology	Intervention	Outcome
Liu, 2008[8] China	N= 21 16 M, 5 F Pre-Op GCS - 13 patients > 12 - 5 patients 8 – 12 - 3 patients < 8 Mean age 35 ± n/a 4 patients underwent surgery within 24 hour 17 patients underwent surgery after 24 hour	Volume 22 – 50 ml Midline shift - 16 patients < 10 mm - 5 patients 10 – 15 mm	Twist drill craniotomy and injection of 20 Kilounit of Urokinase three times a day Two patients had to have two craniotomy due to the width of the lesion	**Resolution on CT** Not reported **GCS** - 2 patients never regained full consciousness - 1 patient eventually required craniotomy - 18 patients regained full consciousness when discharged **Functional Outcome** - 16 patients GOS 5 when discharged - 1 patient GOS 4 when discharged No data on the other 4 patients
Wang, 2016[9] China	N= 59 52 M, 7 F Mean Pre-Op GCS n/a Median age 32 (4 – 68) y.o	Median volume 45 (13 – 145) ml - 24 patients 13 to 19 ml - 25 patients 50–145 ml Midline shift n/a	A small hole was drilled for insertion of a draining tube. 24 hour after surgery the hematoma was rinsed with normal saline until solution became clear, then 20.000 – 40.000 unit of urokinase was injected 1-2 times a day. 8 patients with sign of brain herniation underwent initial aspiration before complete craniotomy in the OR	**Resolution on CT** - 8 patients resolved after 1 day - 3 patients resolved after 3 days - 17 patients resolved after 5 days - 31 patients resolved after 7 days **GCS** Not reported **Functional Outcome** - 2 patients died - Barthel index ≤ 40 in 1 - Barthel index 41-60 in 1 Barthel index > 60 in 55

Author and Country	Patients	Radiology	Intervention	Outcome
Shrestha, 2017[10] China	N= 42 33 M, 9 F Pre-Op GCS 8 – 15 Mean age 34 ± 16,3 y.o	Mean volume 38,5 ± 8,7 ml Mean midline shift 4,5 ± 2,7 mm	Single burrhole with urokinase instillation 30.000 – 50.000 IU twice a day The earliest time to intervention was 3-5 days (21 patients)	**Resolution on CT** 3 rebleeding **GCS** Not reported **Functional Outcome** 39 patients discharged uneventfully on Day 4-6 3 patients eventually underwent craniotomy, discharged after two weeks - GOS not reported
Huang, 2012[11] Taiwan	N= 6 4 M, 2 F Mean Pre-Op GCS 7,5 ± 1,2 Mean age 31,6 ± 7,2 y.o	Mean volume 65,3 ± 10,9 ml Midline shift n/a	Endoscopic-assisted evacuation through a burrhole	**Resolution on CT** 48 hour post-op - 2 patients had 12 ml residual hematoma - 1 patient had 5 ml residual hematoma - 1 patient had no residual hematoma - 2 patients had no data **GCS** 100% GCS 15 post-op **Functional Outcome** Not reported
Sheng, 2017[12] China	N= 7 3 M, 4 F Mean Pre-Op GCS 13,28 ± 1,6 Mean age 5,28 ± 2,7 y.o	Mean volume 19,14 ± 6,12 ml Midline shift n/a	Minicraniotomy for posterior fossa EDH	**Resolution on CT** All patients had hematomas evacuated completely **GCS** All patients had GCS of 15 at post-op **Functional Outcome** - All patients had GOS of 5 (mean follow-up 29,3 ± 9,7 mo)

Author and Country	Patients	Radiology	Intervention	Outcome
Adeleye, 2020[17] Nigeria	N= 10 7 M, 3 F Mean Pre-Op GCS 10,9 ± 3,24 Median age 31,5 (4 mo – 54 yr)	Mean volume n/a Midline shift n/a	Minicraniotomy under local anesthesia	**Resolution on CT** Not reported **GCS** 14 ± 1 at discharge **Functional Outcome** In hospital - GOS 5 in 6 patients - GOS 4 in 2 patients - GOS 2 in 1 patients - GOS 1 in 1 patients Median followup 15 month - GOS 5 in 7 patient - GOS 4 in 1 patients - GOS 1 in 1 patient
Zhang, 2018[13] China	N= 23 14 M, 9 F Mean Pre-Op GCS 10 ± 2 Mean age 42 ± n/a	Mean volume 32,5 ± 15,1 ml Midline shift - 18 patients < 10 mm - 5 patients 10 – 15 mm	Middle meningeal artery embolization with gelfoam combined with drainage surgery and use of urokinase 20 kilounit twice a day	**Resolution on CT** Hematoma drained by 83,1% within 4,5 ± 2,5 days **GCS** 14 ± 1 at discharge **Functional Outcome** GOS-E 5,6 ± 1 at discharge GOS-E 7,3 ± 0,7 at 6 months
Fan, 2020[14] China	N= 5 n/a M, n/a F Mean Pre-Op GCS 14,4 ± 0,48 Mean age 54,2 ± n/a	Volume - 2 patients 10 - ≤ 15 ml - 3 patients 15< - ≤ 20 ml Midline shift all < 10 mm	Middle meningeal artery embolization with absolute alcohol	**Resolution on CT** Not reported **GCS** Not reported **Functional Outcome** - Not reported

Author and Country	Patients	Radiology	Intervention	Outcome
Kim, 2016[15] South Korea	N= 4 n/a M, n/a F Mean Pre-Op GCS n/a Mean age n/a	Mean volume 111,3 ± 7,8 ml Midline shift n/a	Bedside USG-assisted clot evacuation for post-decompressive craniectomy EDH. The incision of initial sugery were opened a little to accommodate suction apparatus entry as well as bipolar forceps. The USG guided the direction of the suction tip	**Resolution on CT** Volume reduced to 33,5 ± 4,4 ml Resolved on follow-up CT **GCS** Not reported **Functional Outcome** All patients survived; three required some help but were able to walk without assistance.

midline shift was 4,5 ± 2,7 mm. Twenty-one patients underwent surgery within 3-5 days while the other 21 had surgery after 5 days. The reason for delay was to allow hematoma to liquidate thus facilitating easier drainage. The urokinase dose in this study was 30.000 – 50.000 unit twice a day. The authors found three patients experiencing rebleeding. Thirty-nine patients were discharged uneventfully on day 4-6 while three patients who eventually required craniotomy were discharged after two weeks. The exact GOS was unfortunately not reported.[10]

Burrhole and endoscopic evacuation

Huang and colleagues shared their experience evacuating EDH using endoscopy in 6 patients. Mean volume of the EDH was 65,3 ± 10,9 ml with relatively poor pre-operative GCS (average 7,5 ± 1,2). The size of the burrhole ranged between 2 – 2,8 cm in diameter, depending on the size of the hematoma. The device was a 18 cm rigid endoscope with a diameter of 4 mm. The inner cortex of the bone was undercut to maximize working space. Hematoma was evacuated using suction cannula and bleeding source was cauterized using bipolar. At 48 hour after the procedure, three patients had residual hematoma, one patient showed complete resolution, while the other two had no data. Longer term of follow-up was not reported.[11]

Minicraniotomy

Retrospective study by Sheng et al. reported the use of minicraniectomy for seven paediatrics patients with posterior fossa EDH. After a 5 cm straight paramedian suboccipital incision was made, a burrhole was placed and was enlarged to around 2-3 cm in diameter using bone rongeur. A draining tube was then inserted into the hematoma to aspirate the blood clot as thoroughly as possible and was left in the epidural space for one day. All patients regained full consciousness after the surgery and was seen with GOS 5 during outpatient visit.[12] Similar procedure by Adeleye et al. resulted in favourable outcome (GOS 4 and 5) in eight out of ten patients. One patient died due to extracranial causes and the other one who presented with GCS of 4 succumbed to vegetative state before dying.

Endovascular

Two studies practiced endovascular procedure to embolize the middle meningeal artery (MMA).[13,14] Zhang et al. combined embolization, drainage surgery, and urokinase instillation. After the bleeding point was embolized, the patient was sent to the operating room for burrhole under local anaesthesia and placement of draining tube, through which urokinase was injected. On average the hematoma was cleared by 83,1% within 3-6 days (average 4,5 ± 2,5 days). The patients had average GOS-E of 5,6 ± 1 at discharge which improved to 7,3 ± 0,7 at 6 months.[13] Fan et al. performed similar procedure with a different embolizing agent. A mixture of absolute alcohol and contrast agent in a ratio of 8:2 was given at a dose of 0,03 ml/kg. Compared to pre-operative GCS in Zhang's study (10,9 ± 3,24), the subjects in Fan's study was relatively better (average GCS of 14,4 ± 0,48).. Monthly CT scan was performed until up to 4-6 months of follow-up. Although the hematoma was reported to decrease overtime, data on the subjects' functional outcome was not provided.[14]

Imaging-guided procedure

One study by Kim et al. in 2016 described USG-assisted procedure to evacuate postoperative EDH. This procedure was possible because the initial surgery was decompressive craniectomy for malignant middle cerebral artery infarction, allowing the sonography to detect EDH without bone barrier. The procedure began by detecting the thickness and extension of EDH, and then one stitch was removed to let suction apparatus in. The USG was used as a guide to determine the direction where the suction tip should be pointed to. Bleeding control was achieved endoscopically using coagulator and biocompatible glue. The mean EDH volume in this study was reduced to 33,4 ± 4,4 ml from a staggering initial volume of > 100 ml, and was resolved on follow-up CT.[15]

DISCUSSION

A total of 13 reports with various types of surgeries have been reviewed. The majority of the procedure (8; 61,5%) was burrhole-based approach in which the

hematoma was allowed to drain through a draining tube. Burrhole drainage-only was described in three studies, burrhole drainage with urokinase instillation in three studies, aspiration using needle in one study, and endoscopic-assisted procedure in one study. In those describing burrhole drainage-only procedure, the EDHs were considered to be liquid based on CT appearance.[5–7] The principle of such procedure is basically the same as burrhole drainage in chronic subdural hematoma (cSDH).[18]

Urokinase administration in conjunction with burrhole drainage was described in three studies[8–10], all of which used the fibrinolytic agent at different doses. In one study which used YL-1 needle also injected urokinase to the hematoma cavity.[16] The goal of urokinase administration in these studies were to liquidate the hematoma and facilitate its drainage through the draining tube. Fibrinolysis for other types of intracranial hemorrhage had been described elsewhere previously.[19,20]

In general, many of the reviewed studies[5,7–11,13,15,16] described huge volume of EDH which in standard practice should have prompted emergency craniotomy.[2] Study by Shrestha and colleagues might be the most interesting among others as the authors intentionally waited for a few days to let the EDH liquidate, while the mean pre-operative EDH volume of their patients exceeded 30 ml.[10] Although the authors did explain that none of the patients exhibited signs of brain herniation, and eventually all of the patients survived, delaying surgical procedures for days in case of acute EDH is indeed peculiar.

Similar circumstances can be found in a study by Wang et al., in which EDH ranging from 13 to 145 ml was treated with insertion of draining tube through a drill hole, and was observed for 24 hours. After that, the hematoma was rinsed with normal saline and was further cleared by the help of urokinase.[9] Although the authors mentioned that they recommended such procedure for EDH with low-density appearance on CT, it was not made clear on their cases descriptions. They also mentioned that the procedure might be suitable only for those presenting with fairly good GCS, yet unfortunately the mean GCS of their patients was not provided.

In Kim's study the patients initially had decompressive craniectomy, which might be among the reasons why all of them survived a catastrophic average volume of 111,3 ± 7,8 ml. The authors also explained that the patients had ICP monitor put in place and routine USG performed routinely. In Lu's study, although the average volume of the lesion reached 45 ml, the average time-to-procedure was few hours with clear guideline to proceed to craniotomy should the patient deteriorated.[16] Additionally, the patients in Lu's study had EDH over the transverse sinus, which might be among the reason to pursue minimal invasive surgery. In Habibi's study, the patients presented within few hours and all of them had iso/hypodense lesion which should be able to drain through a tube.

Two studies performed MMA embolization in conjunction to burrhole drainage.[13,14] Fan et al. used absolute alcohol as the embolization agent.[14] Previously, alcohol has been used in endovascular therapy because of its low cost and ease of access. Alcohol was found effective in the intravascular treatment of vascular malformations, dysfunctions, and hematomas.[21,22] Endovascular treatment for EDH might be useful in patients who can't tolerate general anaesthesia.[13] Although burrhole drainage combined with urokinase instillation can also be used for those who are unfit for general anaesthesia, application of fibrinolytic agents may have a certain risk of bleeding.[13,23,24] This treatment modality, however, might be most useful to prevent further hematoma expansion in conservatively-treated small EDH.

Although some of the explained procedures might not be fully applicable to acute traumatic EDH, the development of minimal invasive surgery for EDH should continue with specific orientation towards simple, quick procedure. Most of the patients in the available studies were reported to have favourable outcome, which could be due to quick partial or total decompression achieved through the minimal invasive procedure.

CONCLUSION

Available literatures showed that most minimal invasive surgeries for EDH are suitable mostly for iso/hypodense-appearing EDH, post-operative EDH, or EDH situated near the dural venous sinus. The procedures included burrhole-based procedure, minicraniotomy, imaging-assisted procedure, and endovascular. Minimal invasive surgery for EDH generally resulted in favourable outcome, however larger studies are required to validate the benefit of minimal invasive surgery over, or in conjunction with, standard craniotomy for EDH.

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Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Ethical Consideration

This study is a literature review; therefore, ethical approval is not required.

Author Contribution

Fitra Fitra and Imam Hidayat responsible for the concept, design, and approved the final version for submission to this journal. Rizki Meizikri and Roidah TZ Wathoni contributed to data analysis, manuscript preparation and execution of the study.

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