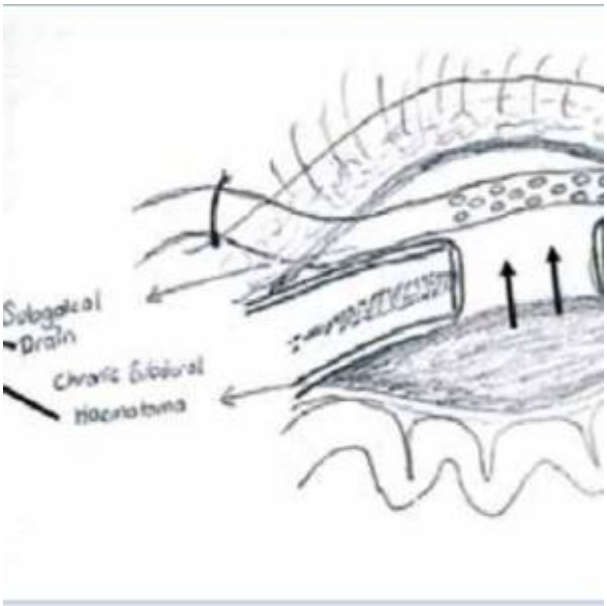
Subperiosteal drain for chronic subdural hematoma

see Subdural drain for chronic subdural hematoma complications.

The occurrence of subdural drain for chronic subdural hematoma misplacement is unignorable because it leads to iatrogenic drain-associated complications and seems to affect bleeding events and hospitalization time of patients undergoing burr hole trephination for chronic subdural hematoma [1].



The use of subdural drains after surgical evacuation of chronic subdural hematoma (CSH) decreases the risk of recurrence and has become the standard of care. Halfway through the controlled, randomized TOSCAN (Randomized Trial of Follow-up CT after Evacuation of Chronic Subdural Hematoma) trial, the authors' institutional guidelines changed to recommend subgaleal instead of subdural drainage. The authors report a post hoc analysis on the influence of drain location in patients participating in the TOSCAN trial.

The study involved 361 patients enrolled in the TOSCAN trial. The patients were stratified according to whether they received surgery before (cohort A) or after (cohort B) the change in institutional protocol. An intention-to-treat analysis was performed with surgery for recurrence as the primary endpoint. Secondary endpoints were outcome-based on modified Rankin Scale scores, seizures, infections, parenchymal brain injuries, and hematoma diameter.

Of the 361 patients included in the analysis, 214 were stratified into cohort A (subdural drainage recommended), while 147 were stratified into cohort B (subgaleal drainage recommended). There was a 31.78% rate of crossover from the subdural to the subgaleal drainage insertion site due to technical or anatomical difficulties. No differences in the rates of reoperation (21.5% [cohort A] vs 25.17% [cohort B], OR 0.81, 95% CI 0.50-1.34, p = 0.415), infections (0.47% [cohort A] vs 2.04% [cohort B], OR 0.23, 95% CI 0.02-2.19, p = 0.199), seizures (3.27% [cohort A] vs 2.72% [cohort B], OR 1.21, 95% CI 0.35-4.21, p = 0.765), or favorable outcomes (modified Rankin Scale score 0-3) at 1 and 6 months (91.26% [cohort A] vs 96.43% [cohort B], OR 0.39, 95% CI 0.14-1.07, p = 0.067; 89.90% [cohort A] vs

91.55% [cohort B], OR 0.82, 95% CI 0.39-1.73, p = 0.605) were noted between the two cohorts. Postoperatively, patients in cohort A had more frequent parenchymal brain tissue injuries (2.8% vs 0%, p = 0.041). Postoperative absolute and relative hematoma reduction was similar irrespective of the location of the drain.

Subgaleal rather than subdural placement of the drain did not increase the risk for reoperation for recurrence of CSHs, nor did it have a negative impact on clinical or radiological outcome. The intention to place a subdural drain was associated with a higher rate of parenchymal injuries [2)].

Subgaleal drainage system is relatively less invasive, safe, and technically easy. So it is applicable for aged and higher risk patients [3)].

Subgaleal suction drain was found to be an effective and safe method in the study of Yadav et al., for chronic subdural hematoma surgery [4)].

It significantly reduced the incidence of recurrence. Similar observations were made in the study of Gazzeri et al. [5)]

They placed the tip of suction drain on burr hole which can assist in continuous evacuation of hematoma or collected air.

Yadav et al., placed suction tip away from burr hole site which could avoid accidental slippage of tip in subdural space. Subgaleal drainage could avoid the risk of an acute hemorrhage from neo membrane injury which may occur during introduction and the removal of a subdural drain. It also reduces chances of brain parenchymal injury especially after suction drain [6)].

A major complication of intracerebral hemorrhage could be due to a blind placement of the subdural drain.

There is a report of one acute SDH after subgaleal drain [7)].

The subgaleal drain reduced the chances of significant pneumocephalus in the study of Yadav et al. [8)].

The placement of subgaleal suction catheter could prevent the collection of subdural air, thus minimizing the risk of recurrence [9)].

Postoperative infection in the subgaleal space has also been reported after subgaleal drainage [10)].

A total of 763 patients with surgically evacuated unilateral CSDH were included for analysis. The recurrence rate was 14% while 12% of patients died during follow-up (1 year). In a association model, hematoma size, drain type, drainage time, presence of complications, and Glasgow Coma Score were significantly associated to recurrence. Subdural drain was associated with a lower recurrence risk than subgaleal drain. The preoperative model included hematoma size, hematoma density, and history of hypertension. The postoperative model included further drain type, drainage time, and surgical complications.

The nomograms allow easy assessment of the recurrence risk for the individual patient, providing a better possibility for individual adjustment of treatment and follow-up. The predictive performance indicates that significant unaccounted or unknown factors still remain. The association test found

passive subdural drain superior to passive subgaleal drain in minimizing the risk of CSDH recurrence [11].

Systematic reviews and meta-analysis

Pranata et al. performed a systematic literature search on topics that assesses the use of SPD compared to SDD in patients with CSDH up until November 2019 from PubMed, EuropePMC, Cochrane Central Database, ScienceDirect, ProQuest, and ClinicalTrials.gov. The primary outcome was recurrent CSDH, and the secondary outcomes were mortality, surgical morbidities, and modified Rankin Score (mRS).

There were a total of 3241 subjects from 10 studies. SPD was shown to reduce recurrent CSDH (OR 0.66 [0.52, 0.84], $p < 0.001$; I2: 17%, $p = 0.30$) compared to SDD. Recurrent CSDH was lower in SPD group in subgroup analysis at 3-months (OR 0.63 [0.49, 0.81]; I2: 68%, $p = 0.04$) and 6-months (OR 0.66 [0.51, 0.85], $p = 0.001$; I2: 77%, $p = 0.01$) follow-up. However, there was no difference in CSDH recurrence upon subgroup analysis of RCTs. Similar mortality was demonstrated between SPD and SDD group ($p = 0.13$). The occurrence of parenchymal injury/new neurological deficit was significantly lower in SPD group (OR 0.26 [0.14, 0.51], $p < 0.001$; I2: 49%, $p = 0.08$). The rate of seizure, ($p = 0.57$), postoperative bleeding ($p = 0.29$), and infection ($p = 0.25$) were shown to be similar in both SPD and SDD group. Overall, the rate of surgical morbidity was significantly lower in SPD group (OR 0.61 [0.44, 0.85], $p = 0.003$; I2: 16%, $p = 0.25$). mRS at the end of follow-up was similar in SPD and SDD group ($p = 0.12$).

SPD was associated with less CSDH recurrence, but a similar rate of mortality, seizures, postoperative bleeding, and infections compared to SDD. The rate of parenchymal injury/new neurological deficit was lower in the SPD group [12].

Using the PRISMA (preferred reporting items for systematic reviews and meta-analyses) guidelines, eligible studies reported up to September 2019 were identified through a search of MEDLINE, EMBASE, and Cochrane Central. Pooled estimates, confidence intervals (CIs), and odds ratios (ORs) were calculated for all outcomes.

Ten studies with 3169 patients were included. The use of a SPD after CSDH burr hole drainage resulted in a significant decrease in recurrences compared with the use of a SDD (OR, 0.73; 95% CI, 0.58-0.92; I2, 14%; P = 0.007). No significant differences were identified between the SPD and SDD groups in the favorable outcomes (OR, 1.29; 95% CI, 1-1.68; I2, 0%; P = 0.05). Adverse event rates, including mortality, seizures, and surgical infection, were not significantly different between the 2 groups. However, the use of SPDs was associated with a lower risk of parenchymal injuries compared with SDDs (OR, 0.29; 95% CI, 0.11-0.76; I2, 0%; P = 0.01).

The results from the present meta-analysis suggest that the use of an SPD is safer and might be more effective than an SDD in the treatment of CSDH. However, more large randomized controlled trials are needed to investigate the use of SPDs in the management of CSDH [13].

Xie et al. searched 4 databases (PubMed, Web of Science, Embase, and Cochrane Library) for relevant reports from January 1995 to September 2019. Two reviewers recorded the major outcomes data as

follows: recurrence, mortality, postoperative seizures, postoperative bleeding events, surgical infection, pneumocephalus, modified Rankin scale scores, and Glasgow outcome scale scores. The pooled odds ratios (ORs) and 95% confidence intervals (CIs) were calculated.

A total of 3149 patients from 10 studies were included in our analysis. Compared with the SSD group, the SPGD group had a lower recurrence rate (OR, 0.72; 95% CI, 0.57-0.91) and a smaller risk of postoperative bleeding (OR, 0.41; 95% CI, 0.22-0.78). Also, no significant differences were found in the incidence of mortality (OR, 0.79; 95% CI, 0.54-1.18), postoperative seizures (OR, 0.74; 95% CI, 0.39-1.40), surgical infection (OR, 0.98; 95% CI, 0.55-1.76), pneumocephalus (OR, 0.58; 95% CI, 0.28-1.20), modified Rankin scale score 0-3 (OR, 1.04 at discharge; OR, 1.33 at 6 months), and Glasgow outcome scale score 4-5 (OR, 1.48; 95% CI, 0.82-2.67).

Burr hole craniotomy with SPGD can be recommended as an effective and safe surgical therapy for patients with chronic subdural hematoma owing to its lower recurrence rate and reduced incidence of postoperative brain injuries, in addition to no increase in the rate of some postoperative complications. However, more studies are necessary for further confirmation [14].

Trials

The chronic subdural hematoma (cSDH)-Drain trial compared chronic subdural hematoma recurrence rates and clinical outcomes associated with the use of subperiosteal drain (SPD) and subdural drain (SDD) after burr-hole drainage for cSDH. This subgroup analysis aimed to determine, whether one drain type is preferable for patients treated with platelet inhibitors (PI) or anticoagulants (AC). This subanalysis included 133 patients treated with PI/AC of the 220 patients from the preceding cSDH-Drain trial. For these patients the association between the drain type used and recurrence rates, mortality, as well as clinical outcome at 6 weeks and 12 months follow-up were analyzed using a logistic regression analysis model. Additionally, recurrence rates, clinical outcome, and mortality were assessed for each PI or AC type separately. The insertion of SPD was associated with 7.35% recurrence rates compared to 13.85 % with SDD in patients treated with PI or AC (OR 0.41, 95% CI 0.06 - 2.65, p=0.36). Outcome measurements and mortality did not differ significantly between both groups at 6 weeks and 12 months follow up. In addition, there was no statistically significant association between drain type and recurrence rate or mortality when comparing data for each PI or AC type. At 24 hours after surgery, significantly more patients under phenprocoumon and natrium-dalteparin had a GCS between 13 and 15 in the SDD group compared to the SPD group (p=0.006), while at 6 weeks follow up significantly more patients in the SDD group treated with ASA had a good mRS (p=0.01). At 12 months no significant difference in outcome measurements was seen for all PI and AC types In patients treated with PI or AC, the insertion of SPD after burr-hole drainage of cSDH showed comparable recurrence, mortality, and long term outcome rates when compared to SDD [15].

Soleman et al. administered a survey to neurosurgeons worldwide with questions relating to the surgical treatment of chronic subdural hematoma, with an emphasis on their practices concerning the use of a drain.

The preferred surgical technique was burr-hole drainage (89%). Most surgeons prefer to place a drain (80%), whereas in 56% of the cases the reason for not placing a drain was brain expansion after evacuation. Subdural drains are placed by 50% and subperiosteal drains by 27% of the responders,

whereas 23% place primarily a subdural drain if possible and otherwise a subperiosteal drain. Three quarters of the responders leave the drain for 48 hours and give prophylactic antibiotic treatment, mostly a single-shot dose intraoperatively (70%). Routine postoperative computed tomography is done by 59% mostly within 24-48 hours after surgery (94%). Adjunct treatment to surgery rarely is used (4%).

The publication of grade I evidence in favor of drain use influenced positively this practice worldwide. Some surgeons are still reluctant to insert a drain, especially when the subdural space is narrow after drainage of the hematoma. The insertion of a subperiosteal drain could be a good alternative solution. However, its outcome and efficacy must be evaluated in larger studies [16)].

Unclassified

5: Xie Y, Lu Q, Lenahan C, Yang S, Zhou D, Qi X. A Comparison of Subperiosteal or Subgaleal Drainage with Subdural Drainage on the Outcomes of Chronic Subdural Hematoma: A Meta-Analysis. World Neurosurg. 2020 Mar;135:e723-e730. doi: 10.1016/j.wneu.2019.12.116. Epub 2019 Dec 30. Review. PubMed PMID: 31899385.

6: Lutz K, Kamenova M, Schaedelin S, Guzman R, Mariani L, Fandino J, Soleman J. Time to and Possible Risk Factors for Recurrence after Burr-hole Drainage of Chronic Subdural Hematoma: A Subanalysis of the cSDH-Drain Randomized Controlled Trial. World Neurosurg. 2019 Dec;132:e283-e289. doi: 10.1016/j.wneu.2019.08.175. Epub 2019 Aug 31. PubMed PMID: 31479790.

7: Soleman J, Lutz K, Schaedelin S, Kamenova M, Guzman R, Mariani L, Fandino J. In Reply: Subperiosteal vs Subdural Drain After Burr-Hole Drainage of Chronic Subdural Hematoma: A Randomized Clinical Trial (cSDH-Drain-Trial). Neurosurgery. 2019 Oct 1;85(4):E797-E798. doi: 10.1093/neuros/nyz291. PubMed PMID: 31392310.

8: Agrawal A, Pacheco-Hernandez A, Moscote-Salazar LR. Letter: Subperiosteal vs Subdural Drain After Burr-Hole Drainage of Chronic Subdural Hematoma: A Randomized Clinical Trial (cSDH-Drain-Trial). Neurosurgery. 2019 Oct 1;85(4):E796. doi: 10.1093/neuros/nyz289. PubMed PMID: 31387117.

9: Zhang JJY, Wang S, Foo ASC, Yang M, Quah BL, Sun IS, Ng ZX, Teo K, Pang BC, Yang EW, Lwin S, Chou N, Low SW, Yeo TT, Santarius T, Nga VDW. Outcomes of Subdural Versus Subperiosteal Drain After Burr-Hole Evacuation of Chronic Subdural Hematoma: A Multicenter Cohort Study. World Neurosurg. 2019 Nov;131:e392-e401. doi: 10.1016/j.wneu.2019.07.168. Epub 2019 Jul 30. PubMed PMID: 31369879.

10: Soleman J, Lutz K, Schaedelin S, Kamenova M, Guzman R, Mariani L, Fandino J. Subperiosteal vs Subdural Drain After Burr-Hole Drainage of Chronic Subdural Hematoma: A Randomized Clinical Trial (cSDH-Drain-Trial). Neurosurgery. 2019 Nov 1;85(5):E825-E834. doi: 10.1093/neuros/nyz095. PubMed PMID: 31194877.

11: Soleman J, Kamenova M, Lutz K, Guzman R, Fandino J, Mariani L. Drain Insertion in Chronic Subdural Hematoma: An International Survey of Practice. World Neurosurg. 2017 Aug;104:528-536. doi: 10.1016/j.wneu.2017.04.134. Epub 2017 Apr 28. PubMed PMID: 28461277.

12: Chih AN, Hieng AW, Rahman NA, Abdullah JM. Subperiosteal Drainage versus Subdural Drainage in the management of Chronic Subdural Hematoma (A Comparative Study). Malays J Med Sci. 2017 Mar;24(1):21-30. doi: 10.21315/mjms2017.24.1.3. Epub 2017 Feb 24. PubMed PMID: 28381926;

PubMed Central PMCID: PMC5346000.

13: Soleman J, Lutz K, Schaedelin S, Mariani L, Fandino J. Use of Subperiosteal Drain Versus Subdural Drain in Chronic Subdural Hematomas Treated With Burr-Hole Trepanation: Study Protocol for a Randomized Controlled Trial. JMIR Res Protoc. 2016 Apr 8;5(2):e38. doi: 10.2196/resprot.5339. PubMed PMID: 27059872; PubMed Central PMCID: PMC4841895.

14: Kaliaperumal C, Khalil A, Fenton E, Okafo U, Kaar G, O'Sullivan M, Marks C. A prospective randomised study to compare the utility and outcomes of subdural and subperiosteal drains for the treatment of chronic subdural haematoma. Acta Neurochir (Wien). 2012 Nov;154(11):2083-8; discussion 2088-9. doi: 10.1007/s00701-012-1483-1. Epub 2012 Aug 30. PubMed PMID: 22932864.

15: Bellut D, Woernle CM, Burkhardt JK, Kockro RA, Bertalanffy H, Krayenbühl N. Subdural drainage versus subperiosteal drainage in burr-hole trepanation for symptomatic chronic subdural hematomas. World Neurosurg. 2012 Jan;77(1):111-8. doi: 10.1016/j.wneu.2011.05.036. Epub 2011 Nov 15. PubMed PMID: 22154148.

1)
Kamenova M, Wanderer S, Lipps P, Marbacher S, Mariani L, Soleman J. When the Drain Hits the Brain. World Neurosurg. 2020 Mar 6. pii: S1878-8750(20)30441-1. doi: 10.1016/j.wneu.2020.02.166. [Epub ahead of print] PubMed PMID: 32147547.
2)
Häni L, Vulcu S, Branca M, Fung C, Z'Graggen WJ, Murek M, Raabe A, Beck J, Schucht P. Subdural versus subgaleal drainage for chronic subdural hematomas: a post hoc analysis of the TOSCAN trial. J Neurosurg. 2019 Aug 30:1-9. doi: 10.3171/2019.5.JNS19858. [Epub ahead of print] PubMed PMID: 31470410.
3)
Oral S, Borklu RE, Kucuk A, Ulutabanca H, Selcuklu A. Comparison of subgaleal and subdural closed drainage system in the surgical treatment of chronic subdural hematoma. North Clin Istanb. 2015 Sep 26;2(2):115-121. doi: 10.14744/nci.2015.06977. eCollection 2015. PubMed PMID: 28058351; PubMed Central PMCID: PMC5175088.
4) 8)
Yadav YR, Parihar V, Chourasia ID, Bajaj J, Namdev H. The role of subgaleal suction drain placement in chronic subdural hematoma evacuation. Asian J Neurosurg. 2016 Jul-Sep;11(3):214-8. doi: 10.4103/1793-5482.145096. PubMed PMID: 27366247; PubMed Central PMCID: PMC4849289.
5) 7) 9) 10)
Gazzeri R, Galarza M, Neroni M, Canova A, Refice GM, Esposito S. Continuous subgaleal suction drainage for the treatment of chronic subdural haematoma. Acta Neurochir (Wien). 2007;149(5):487-93; discussion 493. Epub 2007 Mar 28. PubMed PMID: 17387427.
6)
Choudhury AR. Avoidable factors that contribute to complications in the surgical treatment of chronic subdural haematoma. Acta Neurochir (Wien). 1994;129(1-2):15-9. PubMed PMID: 7998490.
11)
Andersen-Ranberg NC, Debrabant B, Poulsen FR, Bergholt B, Hundsholt T, Fugleholm K. The Danish chronic subdural hematoma study-predicting recurrence of chronic subdural hematoma. Acta Neurochir (Wien). 2019 May;161(5):885-894. doi: 10.1007/s00701-019-03858-9. Epub 2019 Mar 26. PubMed PMID: 30915574.
12)
Pranata R, Deka H, July J. Subperiosteal versus subdural drainage after burr hole evacuation of chronic subdural hematoma: systematic review and meta-analysis. Acta Neurochir (Wien). 2020 Mar;162(3):489-498. doi: 10.1007/s00701-019-04208-5. Epub 2020 Jan 15. PubMed PMID: 31940094.

13)
Ding H, Liu S, Quan X, Liao S, Liu L. Subperiosteal versus Subdural Drain After Burr Hole Drainage for Chronic Subdural Hematomas: A Systematic Review and Meta-Analysis. World Neurosurg. 2020 Apr;136:90-100. doi: 10.1016/j.wneu.2019.12.180. Epub 2020 Jan 9. PubMed PMID: 31927124.
14)
Xie Y, Lu Q, Lenahan C, Yang S, Zhou D, Qi X. A Comparison of Subperiosteal or Subgaleal Drainage with Subdural Drainage on the Outcomes of Chronic Subdural Hematoma: A Meta-Analysis. World Neurosurg. 2020 Mar;135:e723-e730. doi: 10.1016/j.wneu.2019.12.116. Epub 2019 Dec 30. Review. PubMed PMID: 31899385.
15)
Kamenova M, Lutz K, Schaedelin S, Fandino J, Mariani L, Soleman J. Subperiosteal versus Subdural Drain after Burr-hole Drainage under blood thinners: a Subanalysis of the cSDH-Drain RCT. World Neurosurg. 2020 Apr 2. pii: S1878-8750(20)30605-7. doi: 10.1016/j.wneu.2020.03.134. [Epub ahead of print] PubMed PMID: 32247794.
16)
Soleman J, Kamenova M, Lutz K, Guzman R, Fandino J, Mariani L. Drain Insertion in Chronic Subdural Hematoma: An International Survey of Practice. World Neurosurg. 2017 Aug;104:528-536. doi: 10.1016/j.wneu.2017.04.134. Epub 2017 Apr 28. PubMed PMID: 28461277.