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Chronic Subdural Haematoma – a Comparison of Two Different Treatment Modalities

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Summary

Burr-hole craniotomy (BHC) and closed-system drainage undoubtedly is currently the most accepted treatment offered in chronic subdural haematoma (CSDH). Although twist-drill trephination (TDT) techniques have been available for years, now a special subdural catheter kit has been launched for treatment of CSDH. In a prospective study, 33 patients with 36 CSDH were treated with a 5-mm TDT regimen and insertion of a CORDIS subdural catheter (CORDIS Corp., Miami, USA). The results are compared with a consecutive series of 33 patients treated previously with an 11-mm BHC and closed-system drainage for 40 CSDH: Recurrence and persistence rate of CSDH treated with TDT necessitating a second intervention was 18.1%, no further surgical intervention was necessary. In BHC treated patients, 33.3% of haematomas had to be re-operated on, another 6.0% had to be re-operated on a third time. Infection rate in BHC treated patients was 18.1% as compared with a 0% infection rate in patients treated with the TDT technique. Mortality rate for the BHC method was 9.0% as compared with 6.0% in the TDT treatment regimen.

Significantly better clinical results are achieved using the TDT technique with insertion of a special subdural catheter, making this procedure superior to the BHC regimen.

Keywords: Subdural haematoma; twist-drill trephination; burr-hole craniotomy.

Introduction

Although recent evaluation of the role of open craniotomy in the treatment of chronic subdural haematoma (CSDH) has indicated no disadvantages in carrying out this procedure [6], nowadays the vast majority of neurosurgeons prefer to use a variety of less invasive surgical methods offering burr-hole craniotomy (BHC) or twist-drill trephination (TDT) regimen with single evacuation or continuous closed-system drainage of CSDH [3, 4, 7, 9, 12, 13, 16]. Other surgeons propose additional peri-operative lumbar intrathecal injection of Ringer's lactate solution after CSDH evacuation [5] or replacement of haematoma with oxygen after subdural tapping [1, 2]. Prospective clinical trials with continuous irrigation-drainage have also been performed [14]. As the population admitted to neurosurgical treatment for CSDH consists mainly of elderly patients with additional anaesthesiological risk factors or severe underlying disease, and as neurological constitution necessitates prompt therapeutic procedures, the least invasive regimen with the best therapeutic result and fastest remobilization marks the best therapy for treatment of these patients. Keeping in mind the goal of the least invasive but best outcome treatment, we compared the technical results and clinical outcome of two different treatment modalities prospectively studying the outcome of 33 patients treated for 36 CSDH via 5-mm TDT and insertion of a CORDIS subdural catheter. The results are compared with a consecutive number of 33 patients treated with single BHC and insertion of 1–2 Robinson Drainage System catheters (H.G. Wallace Ltd., Colchester, UK).

Patients and Methods

1. Treatment Protocol

From January to September 1996, 33 consecutive patients were admitted for neurosurgical treatment of 36 CSDH, these patients were treated prospectively according to the following treatment protocol:

After CT-diagnosis of uni- or bilateral CSDH and clinical examination, local hair-shave and infiltration with local anaesthesia, the patients underwent perpendicular bedside 5-mm TDT encompassing the area of maximal haematoma width. Then, the extended CORDIS Subdural Catheter head was placed in the subdural space and the wire introducer was pulled out. Afterwards the haematoma was gently aspirated and the amount was quantified, until the patient complained about an increasing headache or until the effusion stopped. The tubing was then connected to an empty plasma bag with a LUER connector, situated 40–50 cm below the head. The closed-system drainage was changed daily and if obstructed, the tubing was flushed with up to 2 ml of isotonic sodium chloride solution. On the first postoperative day a native CT scan was taken to assess the amount of haematoma evacuation. When the effusion dried-up or cleared to liquorous consistence, the closed-system drainage was removed after CT scan control. If the neurological deficit persisted or clinical deterioration occurred, CT scan was repeated earlier. After discharge the patients were re-evaluated again 1 week, 2 weeks, 4 weeks, and 10 weeks after surgery in the out-patient clinic.

The data were compared with a group of 33 consecutive patients treated by the BHC from January to September 1993:

After CT diagnosis and clinical examination, these patients were transferred to the operating theatre: a complete hair-shave and administration of local anaesthesia was done and an 11-mm BHC with small enlargement with a punch was performed after a 2–3 cm skin incision over the area of maximal haematoma width. After cruciate incision of the dura mater and outer neomembrane, the oily ("coca-cola") content of the haematoma usually flew out spontaneously due to the pressure. Then, the haematoma cavity was rinsed with isotonic sodium chloride solution, evacuating possibly solid haematoma clots. Finally, 1–2 perforated 14-CH Robinson Drainage System tubes (H.G. Wallace Ltd., Colchester, UK) were inserted into the haematoma cavity, if possible, bidirectionally. After stepwise wound-closure, the drainage tubes were connected to empty plasma bags and positioned 40–50 cm below the head. The plasma bags were changed daily, and the drainage catheter was flushed if necessary. The external drainage was removed after drying-up of the haematoma secretion and CT-confirmation of adequate treatment.

A single exclusion from insertion of a CORDIS subdural catheter was observed, when the CT taken on admission indicated that the CSDH was accompanied by more than 50% acute hyperdense bleeding within the haematoma cavity. From our experience, predominating subacute and acute clot material can obstruct the thin CORDIS drainage tube and so persistance of the haematoma continues. In this case, BHC was performed in the operating theatre as described above. During our prospective study period, only one single patient was excluded from the TDT regimen showing more than 50% accompanying hyperdense subdural bleeding due to deranged oral anticoagulant therapy, and thus, a BHC-evacuation was performed.

2. *Follow-up*

Anamnestic data and neurological performance were evaluated according to Markwalder's Grading Scale (MGS) [12] on admission, on first postop. day, at first discharge, and similarly, during following in-patient stays and later out-patient controls (Table 1).

CT scans obtained were repeatedly evaluated for different parameters, such as location and maximal haematoma width, density, acute haemorrhage, septation, and compression signs, e.g., cortical flattening, ventricular, midline, and cisternal compression or shifting.

In TDT treated patients daily effusions from continuous drainage were measured until removal of the catheter.

The number of surgical interventions following these procedures due to persistence or relapse of haematoma were evaluated as well as morbidity and mortality aspects in both patient groups. Similarly the total duration of in-patient and out-patient follow-up was compared. Numbers obtained were statistically evaluated for significance using a student's t-test for p values < 0.05.

An indication for surgical re-intervention was observed if persisting or relapsing subdural haematoma exceeded the relative thickness of the skull in any follow-up CT control, irrespective of the neurological status found after the first operation. In our opinion, the reason for this aggressive surgical regimen may be substantiated by the presence of ongoing repeated microhaemorrhages from the neocapillary network in the outer neomembrane with aggravation by the fibrinolytic activity of fibrinogen degradation products [10], thus placing the patient at risk for clinical deterioration due to rebleeding.

Table 1. *Neurological Grading According to Markwalder's Grading Scale (MGS) [12]*

MGS 0	patient neurologically normal
MGS 1	patient alert and oriented; mild symptoms such as headache; absent or mild neurological deficit, such as reflex asymmetry
MGS 2	patient drowsy or disoriented with variable neurological deficit, such as hemiparesis
MGS 3	patient stuporous but responding appropriately to noxious stimuli; severe focal signs such as hemiplegia
MGS 4	patient comatose with absent motor responses to painful stimuli; decerebrate or decorticate posturing

Results

1. *Patient Population and Clinical Features on Admission*

The epidemiological data in both patient groups proved to be nearly identical (Table 2).

The mean duration of follow-up in both subgroups was 81 days and 82 days for the TDT- and BHC-group, respectively.

A distinct trauma event was remembered in about half of all patients in both groups with a mean interval of more than one month until first admission.

The main subjective complaints were headache and vigilance impairment in more than half of the

Table 2. *Sex and Age Distribution in Both Patient Groups*

	TDT-group	BHC-group
Female	12 pats.	12 pats.
Male	21 pats.	21 pats.
Total	33 pats.	33 pats.
Mean age (years)	69.7 y; range 43.6–91.1 y; SD 12.68 y	70.0 y; range 31.8–88.6 y; SD 15.0 y

Table 3. *Anamnestic Data and Subjective Complaints in Both Patient Groups*

	TDT-group	BHC-group
History of trauma	16 pats.	19 pats.
Interval trauma-admission (mean days)	52 days	43 days
Headache	22 pats.	15 pats.
Vigilance impairment	19 pats.	22 pats.
Weakness of extremities	9 pats.	12 pats.
Vertigo/gait disturbance	9 pats.	7 pats.
Speech disorder	7 pats.	10 pats.
Nausea/vomiting	1 pat.	3 pats.
Numbness of extremities	1 pat.	1 pat.

Table 4. *Neurological Findings on Admission in Both Patient Groups*

	TDT-group	BHC-group
Impairment of conscious level	25 pats.	21 pats.
Gait disturbance	20 pats.	16 pats.
Motoric paresis	16 pats.	13 pats.
Disorientation	11 pats.	19 pats.
Aphasic disorder	10 pats.	13 pats.
Sensible paresis	0 pat.	0 pat.

Table 5. *Neurological Grading According to Markwalder (MGS) [12] in Both Patient Groups*

MGS	TDT-group	BHC-group	TDT-group	BHC-group	TDT-group	BHC-group
	admission		1st postop. day		1 discharge	
0			10	7	25	21
1	6	13	13	11	5	7
2	19	14	8	10	1	2
3	6	5	1	2		
4	2	1	1	3		
Dead					2	3

Statistical evaluation for the comparison of status at discharge is performed excluding 5 patients dying within the first therapeutic period. Neurological grading for 31 and 30 surviving patients at first discharge shows a mean MGS of 0.23 in the TDT-group versus a mean MGS of 0.36 in the BHC-group: However, the statistical difference is not significant with $p = 0.329$

patients in both groups. Weakness of extremities, problems in verbal communication, or vertigo and gait disturbance were noticed by a subgroup of 21% to 36% each. Only a minority of patients cited nausea and vomiting or numbness of extremities (Table 3).

The objective neurological findings on admission revealed similar data for both patient groups with the exception of orientation, which was impaired in 57% of the BHC-group in comparison with 33% of the TDT-group (Table 4). According to these findings, the patients' neurological status according to Markwalder's Grading Scale (MGS) [12] showed almost identical data in comparing the numbers of MGS 1 and MGS 2 patients with MGS 3 and MGS 4 patients (Table 5).

In CT scans on admission, a slight preponderance of the BHC-group concerning ventricular compression and midline shift was noticed. All other CT-features, including registration of visible septation in CT, additional acute subdural haemorrhage, and density of the haemorrhagic effusion, show nearly identical numbers (Table 6).

2. TDT-Group: Clinical Course and Status at Discharge

Intra-operatively no adverse event was noted, such as a convulsive attack or other acute neurological deterioration.

Table 6. *CT Features on Admission*

		TDT-group	BHC-group
Localization	left	16 pats.	16 pats.
	right	14 pats.	10 pats.
	bilateral	3 pats.	7 pats.
Mean distribution	frontal	59%	53%
	temporal	5%	8%
	parietal	36%	39%
	occipital	0%	0%
Density	hypodensity	23 pats.	26 pats.
	isodensity	13 pats.	14 pats.
Acute haemorrhage < 50%		14 pats.	16 pats.
Mean maximal width (mm)		21 mm	22 mm
Visible septations		19 pats.	18 pats.
Compression	cortical	31 pats.	32 pats.
	ventricular	12 pats.	16 pats.
Midline	intact	4 pats.	3 pats.
	shift	29 pats.	30 pats.
Mean midline shift (mm)		11 mm	9 mm
Basal cisterns	intact	16 pats.	17 pats.
	partly compressed	8 pats.	10 pats.
	globally compressed	12 pats.	7 pats.

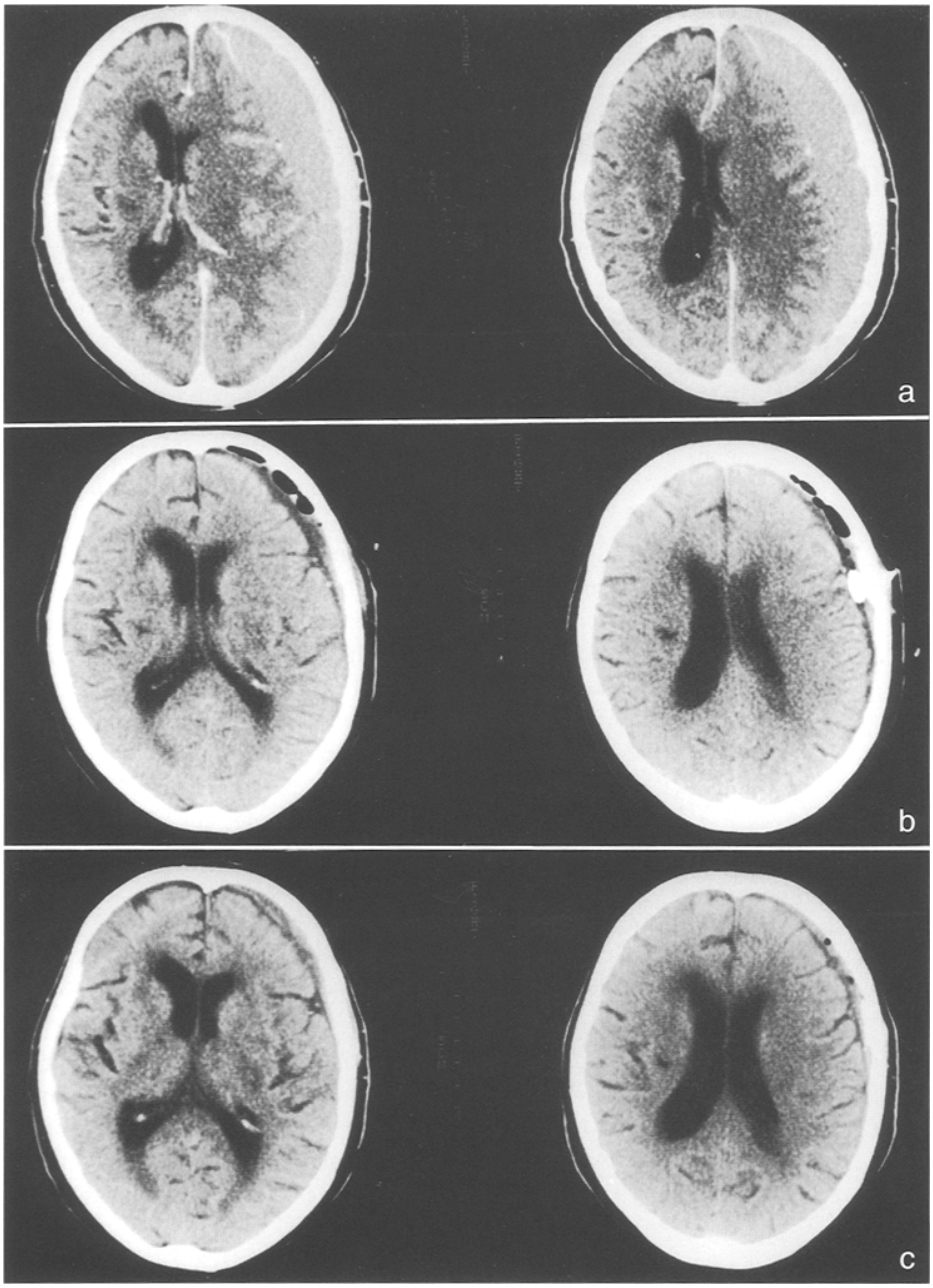

Fig. 1. Ideal follow-up after TDT-technique. (a) Isodense subdural haematoma with ≥ 2 cm width, ipsilateral cortical and ventricular compression, and midline shift of ~1 cm. (b) CT-status on day 1 with the umbrella-like catheter-tip placed in the subdural space, return of the midline structures, ventricular and cortical re-expansion. Discrete residual hypodense subdural effusion of ~1 cm and small air-bubbles. (c) Status on day 10 shows almost total disappearance of the subdural effusion with intact cortical mantle, normal-sized ventricles and intact midline structures

On day 1, neurological assessment already showed an improvement in all MGS 2 and MGS 3 and all but one MGS 4 patients and a steady state in 3 out of 6 MGS 1 patient (Table 5).

The average maximal width of haematoma declined from 21 mm in pre-operative CT to 10 mm in the CT scan performed routinely on day 1 and finally to 4 mm on the last out-patient control. Although neurological improvement was evident throughout the treatment, CT scans routinely performed on day 1 after TDT, showed an ideal position of the subdural catheter tip obtained in only 55% of

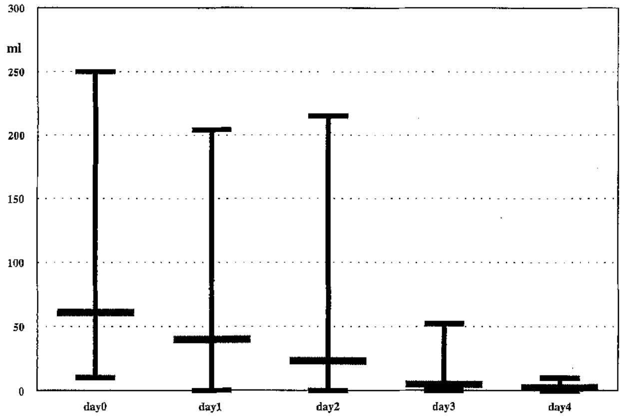

Fig. 2. Mean amount of chronic subdural effusion in TDT-treated patients

Table 7. *Duration of External Drainage and In-Patient Stay*

	TDT-group	BHC-group
Mean external drainage (days)	3.1	5.7
Mean in-patient stay (days)	4.9	9.6

Comparison of mean in-patient stay shows a high significant difference with $p < 0.001$.

patients (Fig. 1). 14 TDTs performed were located 1–3 cm lateral, and 2 TDTs were positioned 3–5 cm around the ideal localization of the needle trephination. No cortical or subcortical contusion was detected, resulting from the 5 mm TDT or from the volume of the umbrella-like catheter tip.

The mean amounts of haematoma effusion per day are shown in Fig. 2: After an average intra-operative aspiration of 67.3 ml, haematoma secretion declined daily to a mean 33.3 ml, 11.4 ml, resp. 1.4 ml.

These numbers lead to a mean duration of external drainage of 3.1 days and a mean amount of 4.9 in-patient days (Table 7).

No peri-operative morbidity such as infection was noted and no adverse events occurred when the umbrella-like subdural catheter was removed. The overall peri-operative mortality rate was 6.0%: Table 8 shows the characteristics of both patient groups, underlying the poor MGS on admission and extensive previous medical history.

At discharge, mean MGS status was 0.23 compared with 2.12 on admission (Table 5).

2.1 Technical Complications during Continuous Drainage

Parallelling no further haematoma effusion on day 1, two patients showed a dislocation of the catheter tip, probably due to unnoticed pulling, in one patient into the cranial bone, in the other patient into the subcutaneous tissue. After immediate insertion of a new subdural catheter along the same pathway the later course was uneventful. In 8 patients, the catheter tip was not placed adjacent to the inner skull bone, in one of these, the catheter tip even turned over with the proximal tubing. However, only one of these 8 patients was re-operated on later for relapse of the haematoma.

2.2 Second Surgical Procedures

Six patients (18.1%) had to be treated surgically a second time for persistence or relapse of a chronic subdural effusion (Fig. 3).

The mean age on first admission was 72.1 years and trauma was remembered in 4 out of 6 patients. Mean clinical status on first admission according to MGS was 2.16 and mean haematoma width was 23 mm on the first CT. It is clearly recognizable that

Table 8. *Mortality Rate in Both Patient Groups*

Patient Age (y)	Medical history	Regimen	MGS admission	MGS day 1	Complication	Death
53	renal transplantation, diabetes mellitus, immune suppression	TDT	4	4	left middle cerebral artery occlusion	day 6
90	cardiac arrhythmia	TDT	3	1	E. coli-pneumonia since day 4 and global respiratory insufficiency	day 13
84		BHC	1	0	left middle cerebral artery occlusion	day 49
58	prostate carcinoma	BHC	4	4	bihemispherical infarction	day 2
66	oral anticoagulation	BHC	4	4	secondary right intracerebral haemorrhage	day 2

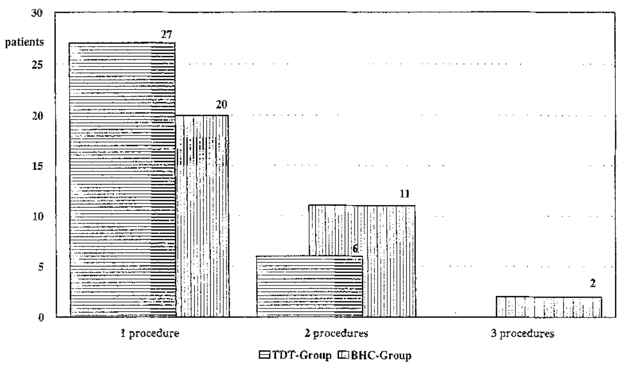

Fig. 3. Numbers of procedures in TDT- versus BHC-group. Comparison of the amount of surgical procedures reveals a one-tailed significant difference with p = 0.041 in favor for the TDT-group

these numbers do not differ consistently from the findings in the total subgroup.

Of these six patients, three patients with improved clinical performance but with asymptomatic persistent haematoma were re-operated on on days 4, 5, and day 7 after first TDT treatment.

Three other patients were re-admitted on days 7, 12, and day 14, respectively, for a true relapsing haematoma: In these latter patients computer tomographic haematoma enlargement was parallelled by clinical deterioration from MGS 0 to MGS 1 and MGS 2.

The later clinical outcome was excellent with an MGS 0 for all six patients after the second surgical intervention.

3. BHC-Group: Clinical Course and Status on Discharge

Intra-operatively, cardiac arrest occurred in a previously "inconspicuous" patient. After interruption of the procedure and rescucitation, the procedure was performed again the next day without any adverse event. One patient complained about severe pain during all intra-operative maneouvres, so that high doses of analgesics and barbiturates had to be administered. In another patient, the burr-hole was performed at the wrong site: After immediate wound closure, the procedure had to be redone at the correct localization.

On the first postoperative day, neurological re-evaluation revealed a completely normal neurological examination without any subjective complaints in 7 patients, and an MGS 1 or MGS 2 status in 11 and 10 patients, respectively, and an MGS 3 status in 2 patients. Three patients showed an MGS 4 status (Table 5).

Six patients (18.1%) developed a wound infection or manifest meningitis during continuous drainage necessitating the removal of the subdural tubes and the implementation of an i.v. antibiotic regimen.

The overall peri-operative mortality was 9%: Table 8 shows the characteristics of these patients with devasting MGS on admission in two patients and secondary middle cerebral artery occlusion in the third patient.

3.1 Second and Third Surgical Procedures

Eleven patients (33%) had to be re-operated on for persistence or relapse of chronic subdural haematoma (Fig. 3): Three patients developed acute subdural rehaemorrhage between days 4–8 necessitating a second surgical intervention. In one of these patients a history of IgG-plasmocytoma with ubiquitous cell depression was known, the two other patients had an unremarkable previous medical history. Eight patients had to be re-operated on for relapse of subdural haematoma an average of 33 days after first surgery.

Another two patients (6%) had to be re-operated on a third time 7 and 10 days, after the second surgical intervention, respectively, for proven relapse of haematoma and clinical deterioration, until full recovery from chronic subdural haematoma occurred.

Discussion

Although Hamilton *et al.* [6] do not find any disadvantage in performing craniotomy in chronic subdural haematoma in comparison to burr-hole techniques, exposing this typical population of elderly and multimorbid persons to an extended surgical technique does not seem to be an adequate treatment choice for routine performance. Consequently, Tator [17] and Horwitz [8] point this out in their comments. Actually, the general attitude in recent years has indicated burr-hole craniotomy and continuous drainage [13, 18] under local anaesthesia as the treatment of choice.

Indeed, comparing the results of a prospective TDT- and BHC-treatment protocol, our outcome data underline the superiority of a minimal invasive procedure:

Although most examined aspects of the admission status show nearly identical numbers when compared in both groups, comparison of mean MGS at first discharge shows a non-significant difference with p = 0.329 in favour for the TDT-treated subgroup. Additionally, in the special population of aged patients suffering from CSDH, it seems to be of great importance, that postoperative neurological improvement is apparently initiated earlier in the TDT-group than in the BHC-group, as is clearly seen in the assessment of MGS status on the first postoperative day (Table 5). Remobilization and, finally, discharge from in-patient treatment into the former normal surroundings can be achieved earlier in the TDT-treated subgroup. This remarkable advantage of TDT-regimen is underlined by the highly significant short in-patient stay with $p < 0.001$ in TDT-treated patients in comparison to BHC-treated patients (Table 7).

Additionally, in times of medical budget curtailment, an almost 50% cut in in-patient treatment duration in TDT-regimen results is an important lowering of treatment costs in this disease. The surgical procedure itself is less expensive in TDT-treatment, too. This procedure with a pin-like prick is designed for bedside performance, and only minimal covering of the surgical field with an aperture drape (Steri-Drape™, Aperture Drape 40 cm × 40 cm; 3M Deutschland GmbH, Neuss, Germany) is necessary, in comparison with extensive use of single-use or re-usable sterile coverings in the operating theatre, lowering the time for preparation and performance of the procedure by more than 50%. As the surgeon is provided with a motor-driven burr-hole trephination set with all accessory equipment in the operating theatre, in TDT-regimen only a hand-driven drilling machine with a 5-mm drill is necessary to create a pathway for the subdural catheter. This saving in technical equipment is aided by the fact that only one nurse is required for assistance while performing the bedside TDT-procedure, whereas in BHC-regimen within the operating theatre, two nurses are usually necessary for performance of the surgical procedure. Evidently, the TDT-regimen provides reasonable saving in medical treatment costs.

The blind insertion of the extended subdural catheter apparently does not harm the neighbouring brain. Additionally, brainward protrusion of the catheter tip as well as even turnover might not disturb continuous effusion, so that technically easy insertion of the system can be assumed. Even with a non-ideal positioning of the catheter tip, no relevant adverse effect was noticed, as we demonstrated in our prospective trial.

Indeed, 33% surgical re-interventions within the BHC-group seems to be unacceptably high, paralleled by an 18.1% degree of re-interventions in the TDT-group, although being significantly better with a $p = 0.041$, this still represents a disappointing high percentage.

The reason for this exceedingly high number becomes obvious, when the indication-setting for retrephination, already explained in the methodology section, is critically reviewed: If Markwalder's advice not to perform second surgery within 10 days after first intervention in case of persistent fluid accumulation, except in cases of no recovery or deterioration, would have been followed [13], the re-operation rate probably could have been reduced by another three patients and could have resulted in a 9% re-operation rate in the TDT-subgroup. In BHC-treated patients, the re-operation rate might have been reduced by two patients, resulting in a 27.2% rate for second interventions, not affecting the number of third interventions in this subgroup. On the other hand, the occurrence of three acute subdural rehaemorrhages within 4–8 days after first surgery within the BHC protocol seems worth mentioning. Apparently, the insertion of bigger-sized subdural drainage tubes within the haematoma cavity and intensive rinsing for evacuation of compact haematoma clots could provoke a rehaemorrhage complication in a number of patients, as this did not occur in the TDT-group. This observation leads to another interesting aspect of CSDH treatment worth mentioning:

One significant technical aspect in BHC-treatment consists in rinsing the haematoma cavity to evacuate possible haematoma clots [3, 7, 12, 19]. Introducing a 5-mm TDT technique with bedside insertion of a special catheter into the haematoma cavity [16], besides adding an even less invasive treatment mode, also changed the previous usual practice of additional rinsing by simply evacuating it slowly. This point might also explain the better clinical outcome of patients in Tabaddor's [16] series as well as in our prospective group in comparison with a comparable BHC-group.

This better outcome could be due to different coagulation and fibrinolysis activity within the haematoma cavity when rinsing the cavity with isotonic sodium chloride solution: Kawakami *et al.* [11] found that, parallel to very low fibrinogen and high FDP concentrations in the haematoma [10], also FPBß 15–42 was markedly elevated in CSDH, marking highly sensitive fibrinolysis by plasmin. When fibrinolytic activity is characteristic for CSDH, it is possible that rinsing additionally supports insufficient clot formation due to preponderance of the plasminogen system. Detailed laboratory investigations comparing the influence of rinsing versus simply evacuating on the configuration of the different parameters of clotting and the fibrinolytic system have already begun and will be presented [15].

At this point, we have to state that a simple evacuation regimen seems to show superior results in comparison with a regimen additionally rinsing the haematoma cavity during the surgical procedure.

Additionally, intensive rinsing might also be a factor responsible for an 18%-infection rate in the BHC-group in comparison to a 0%-infection rate in TDT-treated patients. Another factor influencing this worse result in BHC-treated persons may be found in the larger size of skin and dural opening and should be further investigated.

There is no doubt that a nearly 50% cut in in-patient stay with an equivalent amount of treatment cost savings, a minor number of surgical procedures needed and a 0%-rate of infectious morbidity as shown in this prospective trial marks a definite advantage of the TDT-treatment over the BHC-regimen for this specific, mainly geriatric patient population.

Conclusion

Comparing two minimally invasive procedure protocols for treatment of chronic subdural haematoma, twist-drill trephination with insertion of a specific subdural catheter and continuous drainage is a recommendable treatment choice for bedside use with technically easy and safe performance. It significantly surpasses the results obtained in burr-hole craniotomy techniques in lowering morbidity rate, re-operation rate, and duration of in-patient stay.

References

1. Aoki N (1992) A new therapeutic method for chronic subdural haematoma in adults: replacement of the haematoma with oxygen via percutaneous subdural tapping. Surg Neurol 38: 253–256
2. Aoki N, Sakai T (1993) Computed tomography features immediately after replacement of haematoma with oxygen through percutaneous subdural tapping for the treatment of chronic subdural haematoma in adults. Acta Neurochir (Wien) 120: 44–46
3. Benzel EG, Bridges RM Jr, Hadden TA, Orrison WW (1994) The single burr hole technique for the evacuation of non-acute subdural haematomas. J Trauma 36: 190–194
4. Choudhury AR (1994) Avoidable factors that contribute to complications in the surgical treatment of chronic subdural haematoma. Acta Neurochir (Wien) 129: 15–19
5. Grisoli F, Graziani N, Veragut C, Vincentelli F, Fabrizi AP, Caruso G, Bellard S (1988) Perioperative lumbar injection of Ringer's lactate solution in chronic subdural haematomas: a series of 100 cases. Neurosurgery 23, 5: 616–621
6. Hamilton MG, Frizzell JB, Tranmer BI (1993) Chronic subdural haematoma: the role for craniotomy reevaluated. Neurosurgery 33: 67–72
7. Harders A, Eggert HR, Weigel K (1982) Behandlung des chronischen Subduralhämatoms mit externer geschlossener Drainage. Bericht über 100 konsekutive Fälle. Neurochirurgia 25: 147–152
8. Horwitz NH (1993) Comment to: Hamilton MG, *et al.* Neurosurgery 33: 72
9. Hubschmann OR (1980) Twist drill craniotomy in the treatment of chronic and subacute subdural haematomas in severely iII and elderly patients. Neurosurgery 6: 233–236
10. Ito H, Komai T, Yamamoto S (1975) Fibrin and fibrinogen degradation products in chronic subdural hematoma. Neurol Med Chir 15 (Tokyo) 51–55
11. Kawakami Y, Chikama M, Tamiya T, Shimamura Y (1989) Coagulation and fibrinolysis in chronic subdural hematoma. Neurosurgery 25: 25–29
12. Markwalder TM, Steinsiepe KF, Rohner M, Reichenbach W, Markwalder H (1981) The course of chronic subdural haematomas after burr-hole craniotomy and closed-system drainage. J Neurosurg 55: 390–396
13. Markwalder TM, Seiler RW (1985) Chronic subdural haematomas: to drain or not to drain? Neurosurgery 16: 185–188
14. Ram Z, Hadani M, Sahar A, Spiegelmann R (1993) Continuous irrigation drainage of the subdural space for the treatment of chronic subdural haematoma. A prospective clinical trial. Acta Neurochir (Wien) 120: 40–43
15. Smely C, Madlinger A, Scheremet R: Prospective comparison of coagulation and fibrinolysis parameters during treatment of chronic subdural haematoma with different treatment protocols. (in preparation)
16. Tabaddor K, Shulman K (1977) Definite treatment of chronic subdural haematoma by twist-drill craniotomy and closed-system drainage. J Neurosurg 46: 220–226
17. Tator CH (1993) Comment to: Hamilton MG *et al.* Neurosurgery 33: 72
18. Wakai S, Hashimoto K, Watanabe N, Inoh S, Ochiai C, Nagai M (1990) Efficacy of closed-system drainage in treating chronic subdural haematoma: a prospective comparative study. Neurosurgery 26: 771–773
19. Weisse A, Berney J (1994) Chronic subdural haematomas. Results of a closed drainage method in adults. Acta Neurochir (Wien) 127: 37–40

Comments

This is a clinical research paper evaluating the results of treatment of chronic subdural haematomas with a 11 mm burr-hole versus a twist drill trephination followed by closed-system drainage. Twist drill trephination was performed in a group of 33 patients and compared with a historical group of patients operated on by a burr-hole evacuation and drainage.

Twist drill trephination proved to be superior by shortening the hospital stay of the patients and lowering of the infection rate. Also the re-operation rate due to recurrence of a haematoma was higher in the burr-hole treated group.

Comparing results between non-randomised groups of patients carries a risk of errors; in the presented study it is probably acceptable. It is mentioned that patients with more than 50% of hyperdense blood within a haematoma were excluded from twist-drill trephination. Probably it has not been the case in the burr-hole treated group. If this assumption is correct the two compared groups would have different prognoses. Maybe it is confirmed by a higher proportion of patients with impaired orientation in burr-hole (57%) than in twist-drill trephination (33%).

The authors propose an interesting explanation for the better results of direct drainage of a chronic haematoma in comparison with a drainage following flushing of the haematoma cavity. They are still investigating the problem and announce that new results will be reported soon.

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