Original Investigations

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Modified Twist Drill Technique in the Management of Chronic Subdural Hematoma

Kronik Subdural Hematom Takibinde Modifiye Helezon Matkap Tekniği

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ABSTRACT

AIM: Burr-hole craniostomy is the most efficient and safe choice for surgical drainage of chronic subdural hematoma (CSDH). Although the twist-drill drainage is also relatively safe and time-saving, it carries the risk of inadequate drainage, brain penetration and hematoma formation. Our modified technique helps in avoiding bleeding and brain penetration.

MATERIAL and METHODS: The preferred sites for twist drill were the most curved parts on the cranium. Normal drilling at about 90 degree angle was done on the most curved surfaces while it was at about 60 degree angles on flat surface. This angled drilling and the curved guide wire (hooked in the distal blind end of infant feeding tube), helped to guide infant feeding tube in the hematoma cavity. Dura matter was coagulated using insulated wire.

RESULTS: There was no procedure related hematoma, brain penetration and mortality in any of the 50 patients managed by the modified technique. Infant feeding tube was properly positioned in all the cases. Burr hole evacuation was done in 7 cases (14%) due to inadequate evacuation of the hematoma after TDC.

CONCLUSION: Our modified technique of twist drill drainage is inexpensive, simple, safe and effective alternative technique in the treatment of CSDH.

KEYWORDS: Chronic subdural hematoma, Intracranial subdural hematoma, Subdural hematoma, Minimally invasive technique, Operative surgical procedure

ÖZ

AMAÇ: Burr-hole kraniyostomi kronik subdural hematomun (CSDH) cerrahi drenajı için en etkin ve güvenli tercihtir. Helezon matkap drenajı nispeten güvenli olsa ve zaman tasarrufu yapsa da yetersiz drenaj, beyin penetrasyonu ve hematom oluşması risklerini taşır. Modifiye tekniğimiz kanama ve beyin penetrasyonundan kaçınmaya yardımcı olur.

YÖNTEM ve GEREÇLER: Helezon matkap için tercih edilen yerler kraniyumun en kıvrımlı kısımlarıydı. En kıvrımlı yüzeylerde yaklaşık 90 derece açıyla normal matkapla delme işlemi yapılırken düz yüzeyde açı yaklaşık 60 dereceydi. Bu açılı matkapla delme ve eğri kılavuz tel (infant besleme tüpünün distal kör ucuna kanca şeklinde takılmış), infant besleme tüpünü hematom kavitesine yönlendirmeye yardımcı oldu. Dura mater yalıtımlı telle koagüle edildi.

BULGULAR: Modifiye teknikle takip edilen 50 hastanın hiçbirinde işlemle ilgili hematom, beyin penetrasyonu ve mortalite görülmedi. İnfant besleme tüpü tüm durumlarda uygun şekilde konumlanmıştı. TDC sonrasında hematomun yetersiz boşaltılması nedeniyle 7 vakada (%14) burr-hole ile boşaltma yapıldı.

SONUÇ: Modifiye helezon matkap drenajı tekniğimiz CSDH tedavisinde ucuz, basit, güvenli ve etkin bir alternatif tekniktir.

ANAHTAR SÖZCÜKLER: Kronik subdural hematom, İntrakraniyel subdural hematom, Subdural hematom, Minimal invaziv teknik, Cerrahi işlem

INTRODUCTION

Burr-hole craniostomy is the most efficient, easy and safe choice for surgical drainage of uncomplicated chronic subdural hematoma (CSDH). It is associated with low recurrence rate, and complications (7, 9, 14). The burr hole evacuation is considered as the preferred method of treatment (6, 10). We also favor burr hole evacuation as first line surgical treatment in CSDH.

There are also reports that the twist-drill drainage is relatively safe, time-saving and cost-effective treatment in CSDH (8, 15). Twist drill craniostomy (TDC) can be performed at the bedside (2). It also carries the risk of complications due to the blind technique. The common complications associated with this technique are inadequate drainage, brain penetration, acute epidural hematoma and catheter folding (16). These complications can be avoided by modifications of the technique (1, 4, 5, 12, 13, 16). We are presenting modifications of this technique to prevent complications of TDC.

MATERIAL and METHODS

A prospective study of 50 patients managed by modified twist drill technique was carried out from July 1992 to December 2011 in a tertiary care hospital. The study was approved by the ethics committee of our institute. Written consent was obtained from all the patients. Detailed history and a thorough physical examination were performed. Glasgow coma score (GCS) was used to assess pre and post operative clinical status. Preoperative computed tomography (CT) scans were performed in all the patients. Modified twist drill technique was used in hypo dense CSDH cases detected on computed tomography scans. The indications for modified technique were hypo dense CSDH in elderly or sick patients at high risk for general anesthesia. Although, burr hole was our preferred choice in hypo dense CSDH, this modified technique was used in 8 elderly patients of 80 years or more, who were high risk for general anesthesia. It was also performed in 7 sick patients with associated significant liver, kidney and heart disease, who were high risk for general anesthesia. This was done in 11 patients in very poor neurological status requiring urgent surgery and the facilities of anesthesia were not immediately available. Modified technique was performed in minor operation theatre in 24 patients due to non availability of emergency neurosurgical operation theatre. We are working in a general public hospital, and sometimes routine and emergency theatres are not available due to increased work load. Mixed density, hyper dense lesions, calcified, ossified, organized, and multi loculated CSDH were excluded. Post operative scans were done on first post operative day, at discharge, 3 weeks and 3 months after surgery in all the cases. All post operative complications such as acute hematoma, recurrence, infection and pneumocephalus, etc., were recorded.

Modified twist drill technique

Fifty patients of chronic subdural hematoma were treated from July 1992 to December 2011. This technique was performed under local anesthesia in minor operation theatre. Skull was drilled using 5 mm pointed tip drill bit. The most preferred sites for twist drill were the most curved parts on the anterior frontal and parietal region, just posterior to parietal eminence (Figure 1). The second choice for drill was superiorly positioned most curved site in frontal or parietal area which is usually about 4-6 cm away from midline (Figure 2). These sites on curved surfaces allowed easy and comparatively straight entry into the hematoma cavity. The angled drilling is difficult initially due to tendency of drill bit to slide. Initially about half of the skull thickness drilling should be perpendicular and when firm purchase is achieved, desired angled drilling can be performed. The sites for twist drill were at or near the maximal thickness of the hematoma. If the hematoma size was not significantly large at the most preferred curved frontal or parietal sites, then the drill was made on comparatively flat surface at the maximal hematoma thickness site. Normal drilling at about 90 degree angle was used when drilling was done on the most curved surfaces while it was at about 60 degree angles on flat surface. This angled drilling helps to prevent brain penetration during introduction of an infant feeding tube. Curved guide wire (hooked in the distal blind end of infant feeding tube) was used to guide infant feeding tube in the subdural hematoma cavity (Figure 3). Dura matter was coagulated using insulated wire (Figures 4, 5). The wire, used for coagulation and as the guide wire, was the same as that used for introduction of the ventricular end in ventriculo-peritoneal shunt surgery. Multiple coagulations over the dura matter were usually sufficient to create an opening in the dura matter to allow entry of infant feeding tube in the subdural space. Sudden push by pointed drill bit was used to perforate dura matter if the dural perforation, after multiple coagulations, was not large enough to allow entry of infant feeding tube. Infant feeding tube of 8 French gauges was used for the insulation of the wire and the 10 French gauges tube was used for hematoma drainage. Both the ends of the wire were left none insulated for the purpose of coagulation (Figure 4). About 2-4 mm of the distal end of the wire was kept non insulated for the dural coagulation (Figure 5). Closed drainage system was used for the hematoma drainage.

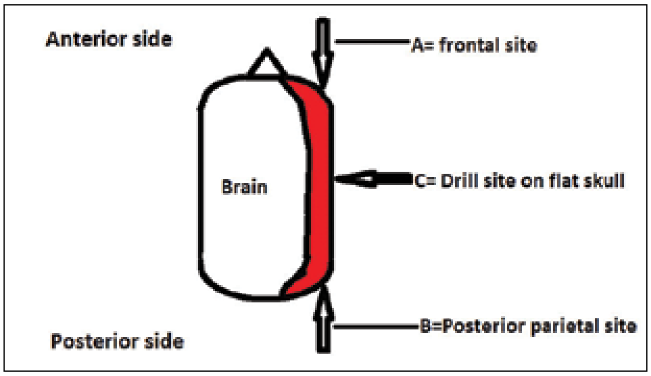

Figure 1: Line diagram of the skull showing preferred site of drill hole on most curved surface at anterior frontal and posterior parietal.

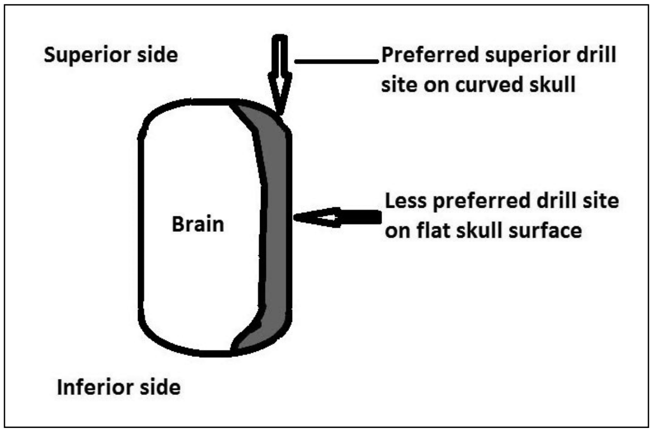

Figure 2: Line diagram of the skull showing the second choice for drill hole site at superiorly positioned most curved part on the frontal or the parietal area which is usually about 4-6 cm away from midline.

Figure 3: Curved guide wire (hooking the distal blind end of the infant feeding tube) is used to guide infant feeding tube in the subdural hematoma cavity.

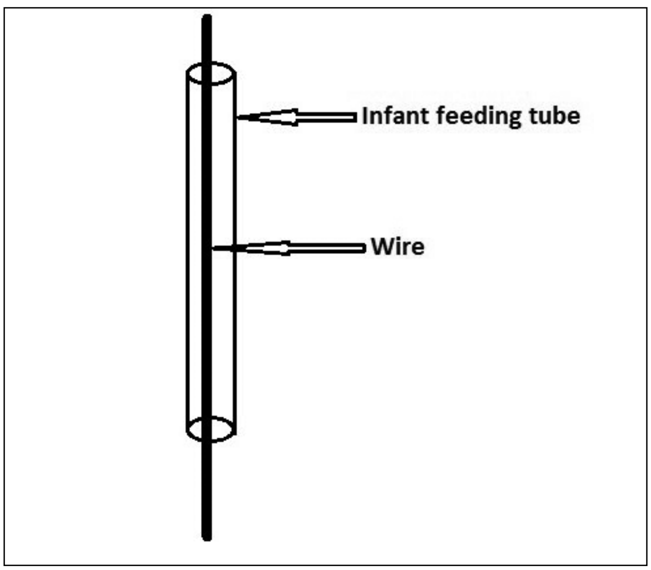

Figure 4: Line diagram showing insulation of the wire by the infant feeding tube. Proximal and distal end of the wire is none insulated for dural coagulation.

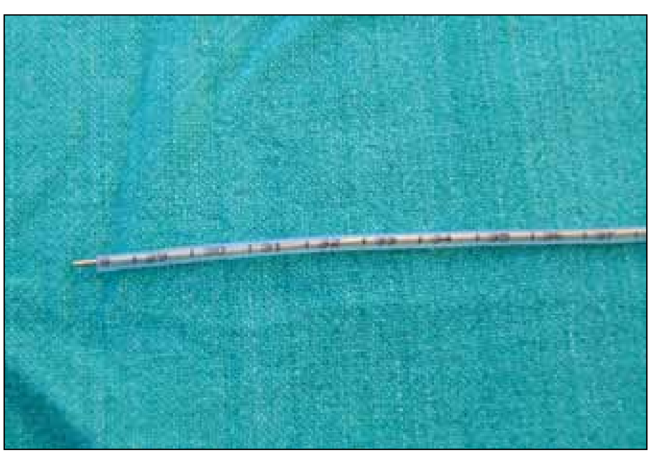

Figure 5: Showing insulation of the wire by the infant feeding tube except at the distal end.

RESULTS

This was a prospective study of 50 patients managed by the TDC drainage from July 1992 to December 2011. Bilateral hematomas were seen in 8 patients. During this period 1800 patients of CSDH were surgically managed. Age ranged from 20-86 years (mean 61). All the patients were unconscious (pre operative GCS range 3-8). There was no procedure-related extra dural hematoma or any other hematoma. Anterior frontal, posterior parietal and superior drill hole position were used in 14, 17 and 6 patients respectively. Drill holes on the comparatively flat part of the cranium at posterior frontal and anterior parietal part were performed in 6 and 7 cases respectively. There was no brain penetration. Infant feeding tube was properly positioned in all the cases. There was no kinking in any of the case. All the deaths (6% mortality) were due to poor pre operative neurological status. There was no mortality related to the procedure. Burr hole evacuation was done in 7 cases (14%) due to inadequate evacuation of the hematoma after TDC.

DISCUSSION

Twist drill drainage could be associated with inadequate drainage, brain penetration, acute epidural hematoma and catheter folding. These complications can be prevented by modifications of the technique (1, 4, 5, 12, 13, 16).

A modified minimally invasive, simple and safe twist drill technique of the subdural evacuating port system (SEPS) for subdural hematoma treatment has been described (1). This technique promotes brain expansion (1). SEPS can be done at the bedside under local anesthesia using a small drill hole. This port avoids risk of brain penetration. There is no need for irrigation in this system. SEPS provides a closed system for hematoma evacuation by gradual decompression using a uniform negative extradural pressure. The SEPS is an effective alternative treatment option in elderly or sick patients who might not tolerate the physiological stress of a craniotomy or burr hole under general anesthesia. It is more effective in the hypo dense subdural collections as compared to the mixed density collections. Significant bleeding after SEPS insertion, though uncommon, can occur (4). Residual hematoma is another concern in SEPS.

Sucu et al (16) observed 17.9% complications in CSDH after twist drill. Complications such as bleeding, brain penetration and inadequate evacuation of hematoma could be avoided by modifications of the technique in their series. Epidural bleeding could occur due to the separation of dura matter from skull due to blunt drill bit tip. This, bleeding from dural separation, was prevented by using pointed tip drill bit and by sudden push on dura matter for the entry in subdural space (16). Brain penetration was avoided by increasing the angle of skull penetration (16). Positioning of drill at posterior parietal also reduced chances of brain penetrations. They increased the drill bit size to allow entry of larger diameter irrigation catheter with large sizes of holes to reduce inadequate drainage.

Another modified bed side technique by Reinges et al was also found to be effective, which could be recommended in patients with poor general condition (12). Twist drill was performed using a 3 mm hand driven drill to penetrate the skull only. The dura and the outer neo membrane of the hematoma were perforated with a 14G Teflon cannula, just exceeding the inner table of the skull. The hematoma was evacuated by spontaneous efflux and Valsalva maneuver with the patient positioned in a 30degree Trendelenburg position. The cannula was placed in dependant position to allow maximum hematoma evacuation. After cessation of CSDH efflux, the cannula was removed and the skin was closed by a single suture with the patient still in the 30 degree Trendelenburg position. The risk of pneumocephalus could be reduced by the immediate skin closure after cessation of spontaneous blood efflux in the 30° Trendelenburg position. This technique, though effective, was associated with acute subdural bleedings, intracerebral bleeding, subdural empyemas, and insufficient hematoma evacuation (12).

Another minimally invasive technique, of placement of hollow screws under local anesthesia, was also found to be effective treatment in most cases of CSDH. About 20% patients needed burr hole surgery after hollow screws treatment highlighting the limitation of inadequate drainage of hematoma by twist drill technique (5). The uses of standard twist drill could be associated with the risk of brain penetrations. Reinges et al modified mechanical twist drill system by a special self-controlling drill and a pre-adjustable distance holder to avoid intracerebral penetration (13).

Our modified technique was safe and effective. Dangerous bleeding complications were prevented by coagulation of dura matter. Brain penetration could be prevented by selecting drill site at the most curved surface. The use of angled drill and curved introduction of the catheter with the help of guide wire also prevented brain penetration on flat surface. Sucu et al (16) also used angled drilling to prevent brain penetration. They also used posterior parietal site to prevent brain penetration. In our modifications the choices of drill sites are more such as anterior frontal, posterior parietal and superiorly placed drill on frontal and parietal area as compared to posterior parietal in Sucu et al series. Inadequate drainage was a limitation in our study which was observed in 14% cases, requiring subsequent burr hole drainage. This inadequate drainage can be prevented by the use of large size catheter (16). This inadequate drainage could be managed by irrigation of fluid containing the tissue plasminogen activator (tPA) (11).

One of the major concerns in TDC is bleeding from dura matter and vascular capsule. Hemorrhage can also occur due to the injury of dural vessels by blind twist drill. The injury of the middle meningeal artery should be avoided by proper position of drill hole. Proper positioning of drill site such as one centimeter anterior to the coronal suture at the level of the superior temporal line could avoid such vascular injury (3). Bleeding could also occur due to the separation of dura matter from skull when the blunt drill bit tip is used. This, bleeding from dural separation, can be prevented by using pointed drill bit and by sudden push on dura matter for the entry in subdural space (16). The direct coagulation of the dura matter in our modified technique was effective in preventing extra dural bleeding and acute hemorrhage in the cavity.

Brain penetration can also occur in the TDC technique. This is due to straight entry of the catheter into the brain from small drill opening. This brain penetration can be avoided by proper selection of the drill hole site. The drill hole should be made in such a way that the entry of catheter is as straight as possible into the hematoma cavity (Figures 1, 2). This was possible in our series by selecting most curved parts on skull on anterior frontal, posterior parietal and superior drill hole sites. It is possible that these preferred sites of drill hole may not be suitable for hematoma evacuation in small percentage of the cases. The increased angle of skull penetration, on flat skull surfaces, can reduce brain penetration chances as suggested in our modification and by Sucu et al. (16). The curved introduction of the catheter by the guide wire, used in our technique, also helped in proper positioning of the catheter in the cavity in all the cases in our series. Insertion of the catheter using guide wire prevented catheter folding or kinking in our patients. Sucu et al used Kirschner wires during introduction of catheter to prevent catheter kinking (16). Curved malleable wire, used in our technique, seems to be better alternative for proper positioning of the catheter and for prevention of catheter kinking.

This study, like all other studies, has certain limitations. It was a small study of 50 patients. These modified techniques should be tried in larger number of cases in CSDH. We all know that the best place to make burr hole is usually at the maximum thickness of the hematoma. The suggested preferred sites, in this modification, may not be at maximum thickness of hematoma or may not have hematoma at all in some cases. The main advantage of TDC is the possibility of performing it at bedside, which may be a consideration due to the high costs of operating theater in some cases. Our modified technique, though can be done under local anesthesia, requires electro cautery which is generally not available bed side. The angled drilling is difficult initially due to tendency of drill bit to slide. Initially about half of skull thickness drilling should be perpendicular to the skull and when firm purchase is achieved, desired angled drilling can be performed. The angled drilling can be performed with the help of the special instrument marketed by Tipmed Inc., Izmir, Turkey which were used by Sucu et al.. This special apparatus with guard could allow angled entry of around 30 degree to the external surface of the skull (16). Inadequate drainage was still a concern after this modification and about 14% required burr hole evacuation. Further studies are required to find out efficacy and safety of irrigation solution containing tissue plasminogen activator (tPA) to reduce incidence of inadequate drainage.

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