Role of the External Lumbar Drain in Management of CSF Leak during or after Transsphenoidal Surgery

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ABSTRACT

Background: CSF leak during or after transsphenoidal surgery is the most common annoying complication that may lead to fatal meningitis. Objective: To define the effectiveness of the external CSF lumbar drain to stop the leak either inserted preoperative, immediate postoperative or delayed postoperative with the same figure of packing to the sella turcica and sphenoid sinus. Methods: We retrospectively reviewed a series of 200 consecutive transsphenoidal surgery for pituitary adenoma, half of cases with intra-operative leak managed with packing only, the another half is managed by pack with CSF lumbar drain. Results: Leak stopped in all cases with lumbar drain except one case 19/20 (99.5%), leak stopped in this case after repacking with lumbar drain, while in cases managed with packing only, leak stopped in 13/20 (65%), leak stopped in 6/7 (85.7%) after lumbar drain, while in the seventh case, the leak did not stop after repacking with lumbar drain but stopped after lumboperitoneal shunt. Conclusion: CSF external lumbar drain markedly reduces the incidence of postoperative leak and also solves the problem of persistent postoperative leak either alone or with repacking. [Egypt J Neurol Psychiat Neurosurg. 2010; 47(3): 483-488]

Key Words: CSF rhinorrhea, pituitary adenoma, transsphenoidal surgery.

INTRODUCTION

Pituitary adenoma is commonly approached through transsphenoidal surgery with less morbidity especially in experienced hands. One of the most annoying complication is the intraoperative CSF leak, we may not able to avoid the intraoperative leak but we try to avoid its persistence postoperatively to prevent its complications like meningitis and pneumocephalus. The incidence of postoperative CSF leak after transsphenoidal surgery is 0.5-15% in reported series. External CSF lumbar drain is a debatable tool, which can be used with packing to reduce the incidence of post-transsphenoidal leak, its usage depends on the personal preference of the surgeon, not emphasized as a rule.

In this study we aimed at comparing the effectiveness of the packing alone to the packing with lumbar drain, also we showed the effectiveness of the lumbar drain in the first group if they leaked postoperatively.

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MATERIAL AND METHODS

We retrospectively reviewed a series of 200 consecutive transsphenoidal operations, all have pituitary adenoma approached via microscopic sublabial transseptal transsphenoidally all of them had done by the same surgeon in Cairo University (A.M) from January 2001 to January 2010. They were 118 women and 82 men, the age at time of TSS ranged from 25-70 years old (mean 47.5 years).

Pathology of all lesions revealed pituitary adenoma. 22 were microadenoma (all were functioning), 178 were macroadenoma (38 were functioning, while 140 were nonfunctioning), 20 were recurrent adenoma with history of previous TSS, four of them had done radiotherapy.

In cases without intraoperative leak, we packed the sella with gelatious sponge and reconstructed the sellar floor with bone fragments harvested during the opening to prevent arachnoidcele.

In this study from 2001 to 2006, 20 cases (10%) with intraoperative leak were packed as follow:

- **1st layer**: On the inferior surface of the arachnoid autologous fascia lata graft about 1 cm x 1 cm soaked with fibrin glue.
- **2nd layer**: Is gelatious sponge.
- **3rd layer**: Is fibrin glue.
4th layer: Bone fragment designed to the opening of sellar floor, placed toward the sella not toward the sphenoid sinus to be rested on the edges of the floor opening.

5th layer: Piece of fat rolled in oxidized cellulose and soaked in fibrin glue inside the sphenoid sinus as shown in Figure (1).

Since 2006, 20 cases with leak (10%) were packed as mentioned previously with immediate insertion of external lumbar drain size 16 gauge to drain 60 cm CSF daily for 5 days.

All patients with intraoperative leak were observed postoperatively for leak after removal of nasal pack for 3 months to detect the delayed leak.

Figure (2) shows an allogram of the management of the leak during the transsphenoidal surgery.

Data were expressed as number and percentage and tabulated using Microsoft EXCEL® 2007.

Figure 1. The following pictures showed three layers during reconstruction of the sella and the sphenoid sinus after transsphenoidal surgery. Slide (A) show the reconstruction of the sellar floor by the harvested bon, slide (B) show the gelatinous sponge layer inside the sella, slide (C) show piece of fat rolled in oxidize cellulose inside the sphenoid sinus.

RESULTS

Intraoperative leak was encountered in 40/200 cases (20%), in all cases the leak is detected immediately, with higher incidence in macroadenomas than microadenomas, especially those with suprasellar extension (22%), as we were more aggressive in macroadenomas to remove the mass totally, the most trigger cause was invasion or adherence to diaphragm sella, it was mostly teared when we tried to remove the last layer adherent to the thinned out diaphragm with postoperative radiology to these cases showed no residual mass, so adhesion to the diaphragm with the aim of total excision, mostly ended by arachnoidal tear.

Incidence is higher in non-functioning adenomas (21.4%) than the functioning ones (16.7%), higher incidence is related to the size and suprasellar extension as shown in Table (1).

Incidence also is apparently higher in recurrent adenomas (35%) mostly due to distorted anatomy and adhesions, it is higher in recurrent cases with radiotherapy (50%) due to decreased vascularity that impend the healing process. Recurrent tumors, radiotherapy and aggressive resection of the tumor, aiming total excision were the most common risk
factors leading to postoperative rhinorrhea in this study. The postoperative leak were detected at different times, in the only case with leak after lumbar drain, leak was detected after 2 weeks, in cases managed firstly without drain, 3/7 leak was detected after one week, 4/7 leak was detected after pack removal. In all cases with postoperative leak we did CT brain before any management to exclude hydrocephalus or pneumocephalus, hydrocephalus was not present, while pneumocephalus was present in 3 cases, with larger amount in the case in which we used the lumbar drain, but with meticulous repacking and lumbar drain, the air disappeared gradually as shown in (Figure 3).

Table 1. Showed the relation of the size, functioning or non-functioning adenoma to number of cases with leak or without leak during transsphenoidal surgery.

<table>
<thead>
<tr>
<th></th>
<th>Without leak</th>
<th>With leak</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Percent</td>
</tr>
<tr>
<td>Macroadenoma (178)</td>
<td>With SSE 100</td>
<td>78</td>
</tr>
<tr>
<td></td>
<td>Without SSE 78</td>
<td>63</td>
</tr>
<tr>
<td>Microadenoma</td>
<td>19</td>
<td>86.4%</td>
</tr>
<tr>
<td>Cushing (15)</td>
<td>14</td>
<td>93.3%</td>
</tr>
<tr>
<td>Prolactinoma (10)</td>
<td>8</td>
<td>80%</td>
</tr>
<tr>
<td>Acromegalic (35)</td>
<td>28</td>
<td>80%</td>
</tr>
<tr>
<td>Non-functioning (140)</td>
<td>110</td>
<td>78.6%</td>
</tr>
<tr>
<td>Recurrent (20)</td>
<td>13</td>
<td>65%</td>
</tr>
<tr>
<td>Radiotherapy (4)</td>
<td>2</td>
<td>50%</td>
</tr>
</tbody>
</table>

Figure 2. Management of the leak during the transsphenoidal surgery.
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**Figure 3.** Follow up CT brain for pituitary adenoma operated upon transsphenoidally with intraoperative leak managed by packing with CSF external lumbar drain, which led to large amount of pneumocephalus due to non meticulous repair, pneumocephalus markedly improved with drain after meticulous repair (A) show axial CT brain with large amount of pneumocephalus immediately after starting leak, (B) axial CT brain of the same patient after meticulous repacking with lumbar drain, complete recovery of the pneumocephalus.

**DISCUSSION**

Postoperative CSF leak is a common complication when the pituitary adenoma is approached transsphenoidally and encountered in reported series 0.5-15%\(^4\), in this series the incidence was 4%.

The risk factors that increase the incidence of the intraoperative leak includes: large adenomas especially those with suprasellar extension, recurrent adenomas, previous radiotherapy, preoperative leak and aggressive surgical maneuver either in non experienced hands or in experienced hands aiming the total excision especially when trying to remove the adherent layer of the tumor to the diaphragma sella, the main risk factor for the postoperative leak is the intraoperative leak, so the postoperative leak incidence increase by the same risk factors of the intraoperative leak, non meticulous repair of the sella is another important factor\(^8,9\).

Many ways have been mentioned in repair if intraoperative CSF leak occurred such as placement of nonabsorbable or slowly absorbable substance into the sella/fat, muscle, biogluce collagen sponge, fibrin glue and sellar floor reconstruction with autologous, heterologous or synthetic material: cartilage, bone, fascia lata, titanium mesh\(^1,9,10\).

In this series we used fascia lata, gelatinous sponge, fibrin glue, fat with oxidize cellulose.

Fat was used to pack the sphenoid sinus not inside the sella to avoid the interpretation of the sellar content on the postoperative MRI, as the reabsorption takes longer time in comparison to bioabsorbable packing such as gelatinous sponge, also chiasmal compression is a rare complication that may occur when we pack the sella with fat\(^11\).

Fibrin glue produce a thin rim of low density which less confounding in postoperative MRI interpretation than fat graft, but it is a costly
material. Performance of the valsalva's maneuver at the end of the surgery is mandatory done either in cases without apparent CSF leak to be sure that no leak or in cases with intraoperative leak to document the good sealing and effectiveness of the sellar reconstruction.

The use of external lumbar drain is in debate, in reported series it may be used preoperatively in selected cases when they expect an intraoperative leak due to large adenomas and or when they intend to use saline infusion to facilitate the descent of the suprasellar part of the adenoma, but this increase the risk of the intraoperative leak. Some authors state that the drain may hide the earlier detection of the CSF leak. Others recommended its use if intraoperative leak occurred, in this work, the lumbar drain had a big role in reducing the leak from (35%) to (5%), it also had a big role in the management of the postoperative leak in the first group managed with packing only, either used alone or with repacking.

The effectiveness of lumbar drain in this work is 99.5% which reached 100% after repacking and lumbar drain to the lonely case leaked after transsphenoidal surgery, this result is near or equal to reported efficacy of Shapiro and Scully.

No complications developed from the lumbar drain such as nerve root irritation, meningitis, CSF overdrainage, but its use increase the time of stay in the hospital and leads to tension pneumocephalus. In spite that it is effective with repacking in the hospital and leads to tension pneumocephalus, this result is near or equal to reported efficacy of Shapiro and Scully.

In spite that it is effective with repacking in management of tension pneumocephalus developed with delayed CSF leak.

All patients were covered by prophylactic antibiotics, the whole time of drain or pack.

In our experience combined duroplasty with fascia lata graft, fibrin glue, gelatinous sponge with fat inside the sphenoid sinus only followed by external lumbar drain, to drain CSF 60 cm/day for 5 days is highly efficient management to prevent persistent CSF leak after transsphenoidal surgery.

[Disclosure: Authors report no conflict of interest]

REFERENCES

دور الدренة القطنية الخارجية لسحب السائل النخاعي أثناء جراحات السينينة النخامية

المتأخّر للسائل النخاعي في علاج التسرب النخاعي من الأنف. كل الحالات التي تسرب فيها السائل النخاعي أثناء الجراحة تم علاجهم بالدروم بالدروم بالدروم. ورد يظر فررلأ تسرر ا فععررا ساسررالن ساي رراالأ قثيررا سا سنررت تررت الا عررت اانةررو رريا ساتررلأ تسرر ا سررالن ساي رر االأ فررلأ سانررا ي ساتررلأ اررت عررتت فععررا ت بعررا سنرراي سايررده ساي افعررت فررع سجيررا واررلأ قع ررا سي دو قساسررلأ فررلأ اررلاج ساتسررا ا سررالن ساي رر االأ فررلأ سانررا ي ساتررلأ اررت عررتت فععررا ت بعررا سنرراي سايررده ساي افعررت فررع سجيررا واررلأ قع ررا سي دو قساسررلأ فررلأ اررلاج ساتسررا ا سررالن ساي رر االأ فررلأ سانررا ي ساتررلأ اررت عررتت فععررا ت بعررا.

وقد خلصت هذه الدراسة إلى أن الدренة القطنية الخارجية لسحب السائل النخاعي تقلل بنسبة كبيرة من التسرب النخاعي بعد جراحات السينينة النخامية من الأنف. وهي أيضاً ذات دور أساسي في علاج التسرب للسائل النخاعي في الحالات التي لا يتم فيها تركيب الدرنة بعد الجراحة مباشرة.