

# T- Shaped Scalp Incision for Paramedian Craniotomies: A Substitute for the Common C Shaped Incisions

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## Abstract

**Background:** The original T shaped skin incision was described for large craniotomies as hemispherectomy procedure and decompressive craniectomy surgery where this skin incision creates two large skin flaps for better exposure without compromising the blood supply for these flaps.

**Aim of Study:** To present our experience with T shaped incisions for paramedian craniotomies analyzing its advantages, complications, and cosmetic outcome.

**Patients and Methods:** We included in this study all patients for whom T shaped skin incision was done for doing a paramedian craniotomy between May 2016 and May 2020 in Kasr Al-Ainy Hospitals. The incision was composed of midline fronto-occipital linear incision in the sagittal plane (sagittal limb), and another linear incision perpendicular on it in the coronal plane and centered on the middle of the estimated craniotomy flap (coronal limb).

**Results:** Thirty patients were included, four pediatric and 26 adult cases. Craniotomies were done for tumor excision (27 cases), vascular lesions (2 cases) and traumatic extradural hematoma (one case). Extension of the sagittal limb of the incision was needed once and reopening of the T-shaped incision occurred in one case. The incision had provided good exposure for all cases, no superficial or deep incisional complications were reported. All wounds healed by primary intention with good cosmetic outcome.

**Conclusion:** T-shaped scalp incision provides rapid and good exposure, interferes little with scalp blood supply, ensures adequate support for the flaps for proper healing, and offers a great flexibility for needed extensions either in primary or repeat surgeries besides having low complications rate and good cosmetic appearance.

**Key Words:** *T-shaped incision - Scalp incisions – Paramedian lesions.*

## Introduction

**NEUROSURGEONS** are always concerned with fashioning the perfect scalp flap that allows adequate exposure of the lesion, has proper vascular supply, can be extended easily when needed, and

allows rapid opening and closure with good cosmetic appearance.

The original T-shaped skin incision was described by kempe for hemispherectomy procedure [1] where the skin incision sufficient for large craniotomy creates two skin flaps for better exposure without compromising the blood supply for these flaps and was described as well for the same rational as one of scalp incision variants for the decompressive craniectomy surgery [2]. This incision is composed of two components: A fronto-occipital midline incision and a linear perpendicular incision extending from a point 2cm posterior to the coronal suture to another point just anterior to the tragus.

Our aim was to present our experience with the T shaped incision for paramedian craniotomies analyzing its advantages, complications, and cosmetic outcome.

## Patients and Methods

We included in this study all patients for whom T-shaped skin incision was done for doing a paramedian craniotomy between May 2016 and May 2020 in Kasr Al-Ainy Hospitals. The incision was performed after localization of the craniotomy flap that was estimated by calculations using coronal suture, craniometric points and Taylor-Haughton lines based on the preoperative MRI films. The T-shaped incision was composed of a fronto-occipital linear incision done at the midline in the sagittal plane which we called the (sagittal limb), and another linear incision perpendicular on it in the coronal plane that was centered on the middle of the estimated craniotomy flap and this is the (coronal limb) of the incision (Fig. 1). Then both flaps were elevated, hemostasis was done, and the flaps were kept everted by fishhook like scalp retractors. Closure of this incision was started by suturing the tip of each flap to the sagittal limb of the incision then the three limbs of the incision are

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sutured as routine scalp incisions. Usual postoperative care of the wounds was applied. The patients' wounds were followed-up for at least 6 months post-surgery.



Fig. (1): The T shaped incision is composed of two linear incisions: A frontoparietal midline sagittal limb (S) and another linear coronal limb (C) centered on the middle of the craniotomy flap.

## Results

Thirty patients were included. Our series included 4 pediatric cases and 26 adults with mean age of 36 years. Our series included 14 males and 16 females. Craniotomies for tumor excision were done in 27 cases, and for vascular lesions in two cases: Sinus pericranii in a girl and arteriovenous malformation in an adult male patient, while in the last case it was done for evacuation of extradural hematoma in a child. Pathologies of the intracranial tumors are summarized in Table (1).

The incision had provided good exposure for all cases (Fig. 2) even for very large lesions. Extension of the sagittal limb of the incision needed once.

No superficial or deep incisional complications were reported. All wounds healed by primary intention with good cosmetic outcome.

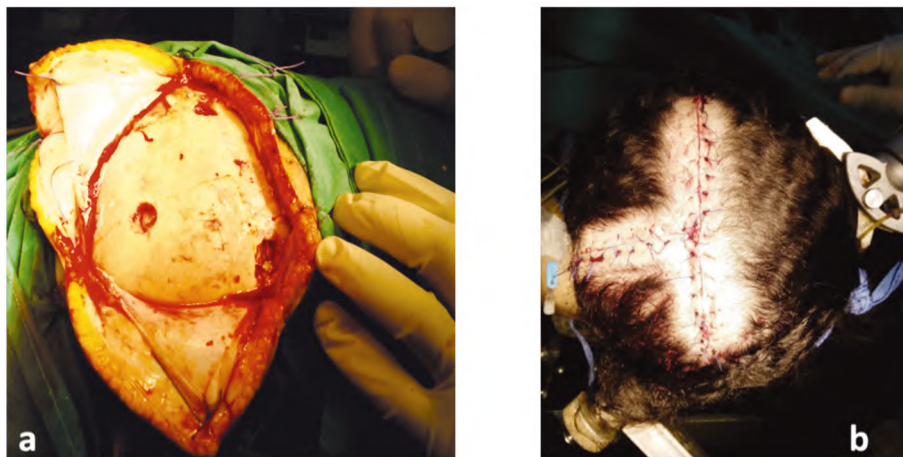


Fig. (2): An intraventricular ependymoma case operated through left T-shaped incision. (A): Wide and good exposure of the craniotomy flap. (B): After immediate closure of the wound showing good approximation. A large subgaleal pocket was available as a reservoir for ventriculo-subgaleal shunt in this case.

Table (1): Summary of different pathologies managed through the T-shaped incision.

The histopathological entity	The site of the lesion	Number of cases
Parasagittal meningioma WHO grade I	Paramedian frontoparietal Paramedian parietooccipital	8
Falcine meningioma WHO grade I	Paramedian frontal	4
Convexity meningioma WHO grade I	Paramedian parietal	2
Subependymal giant astrocytoma	Lateral ventricle	1
Colloid cyst	Third ventricle	1
Pinealoblastoma	Pineal body	1
Ependymoma WHO grade II	Lateral ventricles	6
Oligoastrocytoma WHO grade II	mesial frontal	1
Glioblastoma WHO grade IV	Frontal callosal mass	1
Central neurocytoma	Lateral ventricle	1
Desmoplastic infantile ganglioglioma	Hemispheric mass	1
Sinus pericranii	Midline frontal	1
Arteriovenous malformation	Frontoparietal	1
Extradural hematoma	High frontoparietal	1

Reoperation and reopening of the T-shaped incision was carried on once where a case of a medial frontal low grade glioma on the motor area on the dominant hemisphere was operated upon by awake craniotomy using a T-shaped incision, and as the surgery was aborted due to intraoperative affection of the motor power another surgery was

decided that was done through a contralateral transfalcine approach and it was reached through reopening of the original T incision besides adding a coronal limb in the opposite side, and in this case the original incision gave us a great flexibility for extending it in the opposite side (Fig. 3).

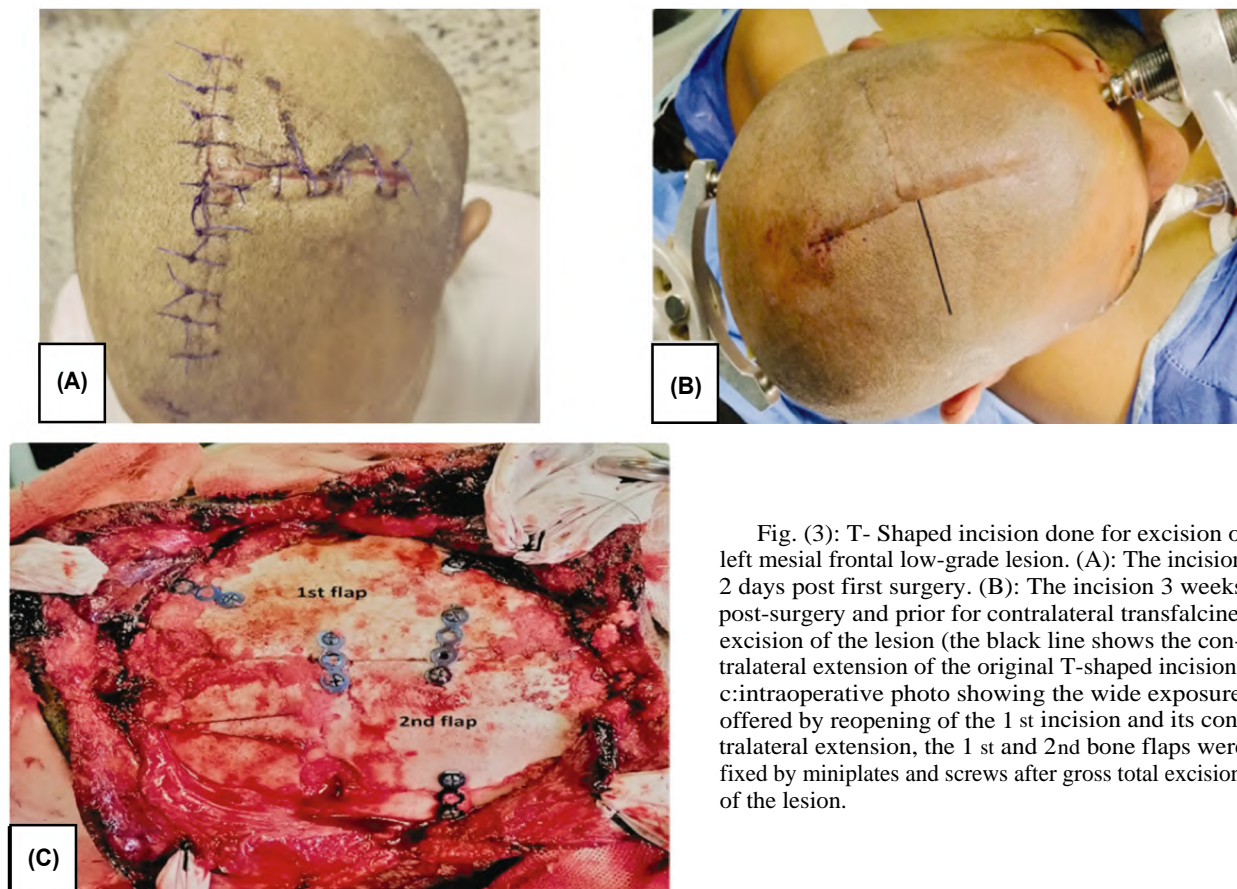


Fig. (3): T- Shaped incision done for excision of left mesial frontal low-grade lesion. (A): The incision 2 days post first surgery. (B): The incision 3 weeks post-surgery and prior for contralateral transfalcine excision of the lesion (the black line shows the contralateral extension of the original T-shaped incision) c:intraoperative photo showing the wide exposure offered by reopening of the 1 st incision and its contralateral extension, the 1 st and 2nd bone flaps were fixed by miniplates and screws after gross total excision of the lesion.

### Discussion

Fashioning a skin incision for paramedian craniotomies needs accurate localization of the bone flap so that the incision facilitates adequate exposure of the flap and the lesion. These incisions are usually C shaped/inverted U over the bone flap or linear if the flap needed is small. The problem usually arises after poor or fair localization that necessitates extending the incision or more retraction on its limbs to widen the flap, a problem that may be confronted especially in developing countries where navigation is limited or absent. Also fashioning an incision for a recurrence beyond the edges of the original craniotomy is sometimes challenging.

The T-shaped incision overcomes this problem to a great extent and this is mainly related to its basic structure which is composed of linear inci-

sions which has a great flexibility to be extended either antero-posteriorly in the sagittal limb of the incision or laterally through extending the limb in the coronal plane and so either of the wound two flaps can be widened safely if any further bony work is needed and this is in contrast to the horse-shoe or the C shaped incisions where extending the limbs of the incision is limited.

The value of being flexible incision is extended also to the repeat surgery which is usually needed for falcine and parasagittal meningiomas where the recurrence may be beyond the edges of the initial resection cavity where the linear incisions making the T-shaped one can be extended as needed easily without bizarre extensions or extensive retraction of the wound edges as the case in the C shaped incisions. Even if another craniotomy on the contralateral side is needed, another contralateral linear incision can be added perpendicular on

the sagittal limb of the original T incision as the case in our series where a contralateral craniotomy was done (Fig. 1). To overcome the problem of extending the horseshoe incisions, some authors made an initial large horseshoe flap as there was an intention to do multi-staged surgery with bilateral craniotomy to excise pineal region meningiomas safely [3] which points to the difficulty of extending a horseshoe flap or making two opposite flaps.

One of the great advantages of the T-shaped incision is that it interferes little with the blood supply of the scalp. The scalp is supplied by five pairs of major vessels arising from both external and internal carotids [4-7] namely: Superficial temporal, posterior auricular and occipital arteries from the external carotid and supraorbital and supratrochlear from the internal carotid. These major vessels flow upwards and branch as coming near the vertex and making rich anastomoses between different territories that are apparently increasing as getting closer to the vertex. Fashioning a skin incision, that avoids these major vessels and interfere little with their branches, creates an ideal well vascularized incision and this is the case with linear incisions in general that avoid transecting many branches as well as the T-shaped incision where its limbs run parallel to the main vessels of the scalp and most of their branches in comparison to C-shaped incisions that transect many branches of these vessels. Also, linear incisions offer numerous surgical therapeutic options for plastic repair in cases of breakdown while horseshoe or C-shaped incisions are less likely to offer such advantages [8,9].

As exposing a large paramedian lesion necessitate in most instances a large scalp flap which has a risk of necrosis or poor healing if the ratio between its width and height was not considered, the T shaped skin incision on the opposite hand creates 2 flaps which gives good exposure besides providing sufficient vascular support for the healing of the incision where each flap will have its own wide base in relation to its height with proper vascularity.

An alternate incision to the horseshoe or C-shaped incision was also described by some authors for midline incisions which is similar in construction to T-shaped one where it is composed of midline sagittal limb from the hair line with its two third in front of the coronal suture then it curves to make a coronal limb directed to the pinna [10]. Such incision was described for anterior transcallosal approach and it has the same advantages of the described T-shaped incision, however it is suitable for a smaller craniotomy flap than that can be done through the Tone.

In intraventricular cases in our series and in an attempt to decrease rates of CSF infection, we have preferred to replace external ventricular drain as a temporary CSF diversion after tumor excision with ventriculo-subgaleal shunt that was described by many authors in the literature [11-14]. This shunt requires a large subgaleal pocket to act as a reservoir for the CSF that usually done by extensive blunt dissection beyond wound edges. In our series the flaps of the wide T shaped incision provided us with a large pocket besides it had facilitated a mild dissection at the base of the posterior flap to accommodate more CSF. No problems regarding tense pocket with mal shunting, nor CSF leak from the wound were encountered.

One of the major concerns after craniotomies is the occurrence of surgical site infections (SSI) with purulent discharge from the incision with spontaneous dehiscence of the wound or its intentional reopening for drainage and debridement [15]. The incidence of SSI in most of the literature ranged from 2% to 5% [16-19]. In our series we did not report any case of wound infection and this may be related to the relatively small number of our cases besides the absence of most of the significant and relevant risk factors in our series that were reported in the literature as CSF leak, high American Society of Anesthesiologists score and reintervention [15,17,20]. However, the absence of infection, CSF leak, wound dehiscence or any other complications of cranial wounds points at least to the fact that T-shaped incision did not increase the risk of scalp incisions complications.

It is worth mentioning that this T-shaped incision provided us with a rapid and easy to handle scalp flaps, large area of the pericranium was available for any graft needed besides good cosmetic outcome and it did not interfere with hair regrowth (Fig. 4).



Fig. (4): A T-shaped incision for a child post 2 weeks from surgery; regrowth of the hair on the incision flaps was not affected.

**Conclusion:**

T-shaped scalp incision provides rapid and good exposure, very little interference with scalp blood supply, ensures adequate support for the flaps of the incision for proper healing, offers a great flexibility for needed extensions either in primary or repeat surgeries besides having low complications rate and good cosmetic appearance.

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## فى جراحات قطع C بدلا من الجروح المعتادة على شكل حرف T شق فروة الرأس على شكل حرف القحف المجاورة لمنتصف الرأس

لعمليات قطع القحف الكبيرة حيث يؤدي هذا الجرح إلى إنشاء T تم وصف شق الجلد على شكل حرف سديلتين كبيرتين للجلد بشكل أفضل دون المساس بإمداد الدم لفروة الرأس والسديلتين. وقد هدفتنا لإجراء T فى هذه الدراسة التى تضمنت جميع المرضى الذين تم عمل شق جلدى لهم على شكل حرف قطع القحف المجاور لمنتصف الرأس بين ٢٠١٦ مايو ومايو ٢٠٢٠ فى مستشفيات قصر العينى إلى ابراز تجربتنا مع هذا الشكل لجروح فروة الرأس وتقييمنا لمزاياها والمضاعفات المحتملة منها. وقد تم تضمين ثلاثين مريضاً منهم أربعة أطفال كانت جراحات قطع القحف لهم إما لاستئصال أورام (٢٧ حالة) أو تشوهات بالأوعية الدموية (حالتان) أو لتفريغ نزيف فوق الأم الجافية (حالة واحدة). وقد وفرت هذه الجروح الكشف المناسب والسريع لما أريد استئصاله والتئمت بنتيجة تجميلية ممتازة كما لم كما T يتم رصد أى مضاعفات سطحية أو عميقة. وخلصنا إلى أن شق فروة الرأس على شكل حرف وأنه يوفر الكشف الجيد والسريع لمكان الجراحة فإنه لا يتداخل كثيراً مع إمدادات الدم لفروة الرأس، ويضمن دعماً دموياً كافياً لسدائل الجرح من أجل الإلتئام الجيد، ويوفر مرونة كبيرة للتمديدات المطلوبة سواء فى العمليات الجراحية الأولى أو المتكررة إلى جانب انخفاض معدل المضاعفات كما أنه يضمن مظهر تجميلى جيد.