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INSTITUTO MEXICANO DEL SEGURO SOCIAL
CENTRO MEDICO NACIONAL SIGLO XXI
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"SÍNDROME PRIMARO DE SILLA TURCA VACIA: EL ROL DE LA HERNIACION EN EL SISTEMA VISUAL (PRIMARY EMPTY SELLA SÍNDROME: THE ROLE OF VISUAL SYSTEM HERNIATION)"

T E S I S

QUE PARA OBTENER EL TÍTULO DE:

N E U R O C I R U J A N O

P R E S E N T A

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DEDICATORIA

Para Brenda: *mi fuente inagotable de inspiración; aliento en los momentos difíciles y compañera en el éxito. Hemos terminado una etapa mas juntos. Te amo.*

Para mis padres: *Briselva y Fortino, no solamente les debo la vida. Este logro es consecuencia de lo que Uds. forjaron en mi. Los amo.*

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A mis compañeros — *Alfonso, Gabriela del Rocío, Juan José, Luis Manuel, Valentín. Finalmente fuimos un equipo que dejara huella en Centro Medico. Suerte vencedores.*

A mis profesores — *Además de sus enseñanzas, cada uno de ellos inculco en mi el deseo de excelencia, superación y liderazgo en este arte. Sigan adelante...*

A todos los pacientes y sus familiares — *Gracias por su confianza, no se dejen sucumbir y continúen con su lucha.*

INDICE

ELSEVIER

Editorial

IN THIS ISSUE . . .

Roitberg's "Research News & Notes" this month discusses a possible treatment for mild traumatic brain injury, and a potential breakthrough in axonal regrowth after spinal cord injury. Both of these developments are potentially useful to neurosurgeons, and worthwhile reading.

Abrahams et al introduce us to a more detailed way of analyzing bleeding and clotting time than the currently used coagulation tests. They used thromboelastography, a simple technique, to measure the hemostatic function in patients undergoing a variety of neurosurgical procedures. The study showed that patients became progressively hypercoagulable during surgery, particularly between intubation and skin incision. This is a very interesting report that could alter the way neurosurgeons approach operations. For example, one of the patients in the study who was shown to be more hypercoagulable than others developed a deep venous thrombosis in the legs. The authors suggest that compression stockings are of no value when applied after induction of anesthesia. More studies using this technique are needed to better understand coagulation status and to allow selection of patients for therapy. The commentary to this article is also excellent.

Nanda et al add another paper on unruptured aneurysms treated by surgery to the literature. Their study is very interesting, and its conclusions seem reasonable. However, their series included more aneurysms larger than 10 mm than have other similar studies, such as the much larger series by Juvela et al. The authors' sample, from the universe of patients with unruptured aneurysms, may not be representative of all patients with unruptured aneurysms. Their conclusions must be related to the sample itself, not generalized to the universe of patients with unruptured aneurysms.

This generalization of results is the same problem I had with the International Study of Unruptured Intracranial Aneurysms. I have written articles in *Surgical Neurology* that have been critical of the ISUIA study, and I have concerns about this type of study as well. In their discussion, Nanda et al state that "Regardless of its size, an unruptured aneurysm should be considered for surgical obliteration." This sounds to me like the authors' opinion was formed before the study was done. They go on to state that "The literature has clearly shown that the risks of surgical intervention are far less compared to the risks of the natural history of aneurysms with SAH." They then cite the often-quoted mortality and morbidity statistics for surgery on unruptured intracranial aneurysms. However, in this study, the neurosurgical examination of the patient after surgery is cursory and does not go into details of the cognitive and other brain functions of the patient, or take into account changes in the patient's lifestyle resulting from surgery. To me, one of the most important aspects of the ISUIA study was its detailed neuropsychological assessment of the patient after surgery. This assessment showed a cognitive deficit of 12–15%, which is not usually taken into consideration by surgeons in evaluating the morbidity statistics of their patients.

Finally, the authors have forgotten to consider interventional treatment of unruptured intracranial aneurysms, which will likely produce equal or lower mortality and morbidity rates in properly selected patients. For these reasons, I disagree with the opinions of our commentators to the article. What do you think?

My concern about skull base surgery is that it often seems to be performed with little concern for the complications the patient must suffer or for the morbidity rate of the surgery. I have been to skull base meetings in which the preoperative and postoperative imaging studies are shown, but little attention is given to the patient or to the complications of the surgery. I once had a professor who told me "Don't let the abdominal wall stand between you and the diagnosis." This approach seems to be popular for skull base surgery as well, but to me, is seriously flawed. Sabit et al present a superb anatomic study in which a reasoned surgical path to the infratemporal fossa is developed. According to the authors, this approach allows the surgeon to avoid other "disfiguring" approaches to the region, allows greater access to the lesion, and eliminates

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the serious complications associated with other routes that are not often discussed. Even if you are not a skull base surgeon, I recommend that you read the abstract and introduction, and as much of the surgical approach as interests you. The discussion is an excellent analysis of the advantages and disadvantages of the various approaches to this region. This is a first-rate contribution that is very thoughtful. My only questions are for what indications will it be necessary? Once you reach the tumor, how much can you remove? Is the surgery curative or only palliative? If palliative, is this extensive surgery necessary at all? What is the biology of the tumor? Every surgeon should be taught thoughtful approaches to the skull base such as this one, and every surgeon should be able to consider and select from all the options to provide the best treatment for their patients.

Ioffe and coauthors have contributed a specialized report on the radiation dose to the fetus and ovaries during gamma knife radiosurgery. This is an extremely well-done study. I suggest that you read the abstract and the commentary at the end of the article in particular. There are two points to be learned from this paper: (1) as neurosurgeons become more superspecialized, they will learn more about the risks of the treatments they employ, be they surgical or non-surgical; and (2) radiation therapy is not harmless. I have received radiation therapy twice in my life; once 50 years ago for tonsillitis—a treatment recommended by my physician father, who obviously would not want to harm his son. Twenty years ago, it was found that patients who had this therapy were more susceptible to thyroid cancer; I am now checked for this every year. On the second occasion, I had abdominal radiation after removal of a testicular tumor. Both the radiation therapists and the literature stated that there should be no complications from this therapy because the dose was so low. However, over the past 15 years I have developed a radiation sympathectomy that is now just being recognized as a complication of that treatment. As surgeons, we see immediately the effects and complications of our therapy. This is not true for radiation therapy, and most likely is not true for radiosurgery either—complications may occur years or even decades later.

The paper on primary empty sella syndrome by Guinto and colleagues is outstanding clinical science. Even if you are not a pituitary surgeon, you should read it. The authors made careful clinical observations of their patients, and were led to their conclusions by the data they obtained. What is the cause of the visual deficits in patients whose optic chiasms or nerves are not displaced into the sella? Read their conclusions and find out why. The authors developed a very creative approach to solving this problem. This is a superb case report and emphasizes why the individual observations of physicians are key to an understanding of the puzzles of medicine.

There are three interesting case reports dealing with aneurysms and fistulas. The first, by Kojima et al, describes a case in which conventional angiography missed a ruptured aneurysm, which was subsequently detected by 3-dimensional subtraction angiography. A second case reported by Saatci et al describes the obliteration of two "kissing aneurysms" at a fenestrated basilar artery by coiling. Yassari et al report the development of an arteriovenous fistula after craniotomy.

My editorial this month is about my visit to Taiwan, describing the system of medicine and neurosurgery in that country and what it may mean for all of us.

James I. Ausman, M.D., Ph.D.
Editor

ELSEVIER

Neoplasm

PRIMARY EMPTY SELLA SYNDROME: THE ROLE OF VISUAL SYSTEM HERNIATION

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Guinto G, del Valle R, Nishimura E, Mercado M, Nettel B, Salazar F. Primary empty sella syndrome: the role of visual system herniation. Surg Neurol 2002;58:42–8.

BACKGROUND

It has been traditionally accepted that ophthalmologic alterations in cases of primary empty sella syndrome are caused by the herniation of the visual system in the pituitary fossa, but this cannot be stated categorically.

METHODS

Two female patients with primary empty sella syndrome and visual field defects were included in this series. The peculiarity of these cases was that in neither of them was there an evident herniation of the visual system. In the absence of other causes that could explain the visual defects, the patients were operated on through a transsphenoidal approach.

RESULTS

Both patients showed immediate improvement of their visual deficits without recurrence. Postoperative imaging studies have shown continuance of an adequate elevation of the sellar contents during the 5-year follow-up period.

CONCLUSIONS

Visual field defects in cases of primary empty sella syndrome may occur even without radiological evidence of herniation of the visual system. The fact that the two patients described in this paper improved after surgery supports other reports that in this syndrome traction on the infundibular stalk may cause some microscopic anatomic alteration in the visual system or in its vascular supply that is not evident on imaging studies.

KEY WORDS

Empty sella syndrome, headaches, transsphenoidal surgery, visual deficit.

The great majority of patients with primary empty sella are asymptomatic and do not require any management [15]. In very rare cases, however, they develop visual deficits or cerebrospinal fluid leaks that make surgical treatment necessary [6,10,11,14,16,19–21]. Even though it has been mentioned that visual defects are caused by the herniation of the optic system toward the sella [12,13,16, 19,21], there is no evidence to prove this hypothesis because there are reports of patients with primary empty sella syndrome (PESS) and a clear herniation of the optic system toward the pituitary fossa, but with normal vision, as well as patients with defects in the visual field without herniation [2].

In this paper we present two patients with PESS and visual field defects, but without any radiologic evidence of optic system herniation. The patients were surgically treated using a slight modification of previous procedures that allowed a more precise elevation of the sellar contents. The technical details are discussed, as are the clinical findings.

MATERIALS AND METHODS

CASE 1

A 40-year-old woman presented with a long history of headaches. One year before admission to the hospital (January 1992), she presented with reduction in her visual field, mostly in the right eye. Her headaches were increasing, but could be controlled with medication. The patient had had two pregnancies. Physical examination showed that she was not obese. Her arterial pressure was normal. There was no papilledema and only the visual field defect could be noted. A complete endocrine analysis was carried out, but all hormone levels were normal. Magnetic resonance imaging (MRI) showed the typical herniation of the subarachnoid space into the sella, but the visual system was in its normal position (Figure 1). Ophthalmologic evaluation demon-

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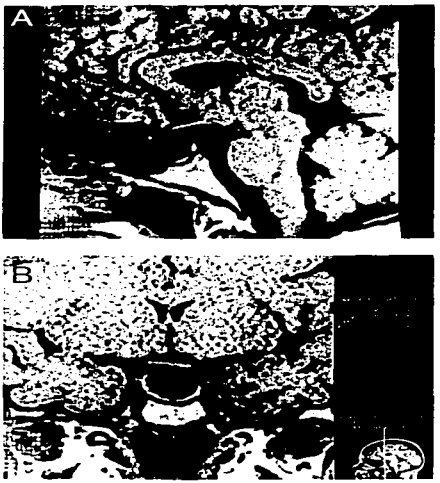


1 Case 1. MRI showing typical findings in PESS. Observe how the arachnoid space is herniated toward the sella and the pituitary gland is flattened on the bottom, but the optic system is anatomically normal. A: sagittal view. B: coronal view.

strated a right homonymous superior quadrantanopia. The lumbar puncture (including the pressure) and ocular pressures were normal.

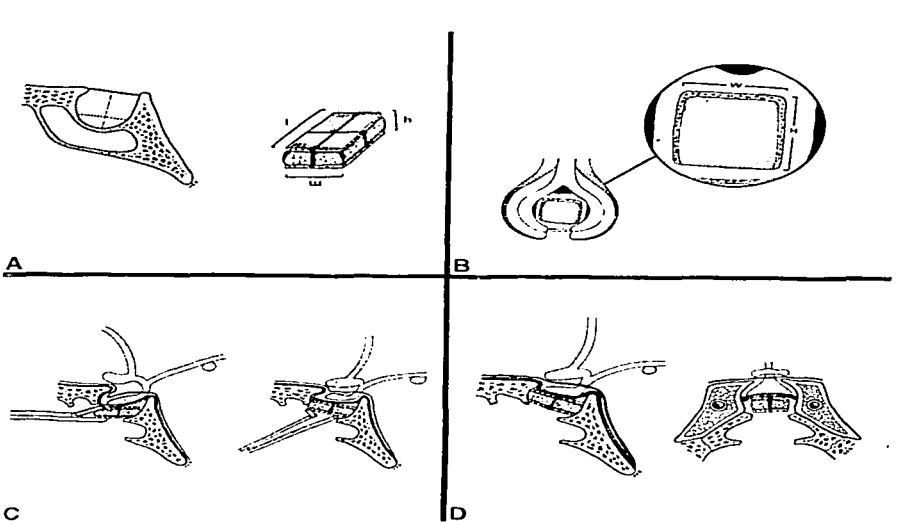
CASE 2

This 43-year-old woman had a history of multiple (5) pregnancies. A slow progressive bilateral reduction of the patient's visual field began 2 years before her admission to the hospital (October 1994). Her daily activities were hampered by severe headaches that did not respond to medication. Physical examination showed that she was obese (+ +), with slight elevation of her arterial pressure (140/90) and with an obvious reduction in her visual field. Her hormone levels were normal and the ophthalmologic evaluation demonstrated an evident concentric narrowing in the campimetry, mostly in the right eye. Because of intense headaches and the visual defect, even in the absence of papilledema, the possibility of pseudotumor cedrebri was considered, so a lumbar puncture was performed, but pressure was found to be in the normal range. The MRI showed findings similar to those of the previous case. Ocular pressure was also normal.

SURGICAL TECHNIQUE

Both patients were operated on via a sublabial, transseptal, transsphenoidal approach [9]. The sellar floor was opened in the traditional way, but not too wide. The detachment of the dura mater was performed gradually using cottonoids; a temporary transitory packing was placed in the sella for a few minutes to prevent bleeding from the cavernous sinus. The graft that would be used for the elevation of the sellar pouch was prepared as follows (Figure 2): a fragment of muscle (fat might also be used) obtained from the thigh was wrapped in a square of fascia lata to form a package that was attached with a nonabsorbable suture stitch. This package was then put between two blocks of bone taken from the nasal septum, to form a kind of sandwich, which was then attached with the same non-absorbable suture, which finally conforms the graft (Figure 2A). The exact dimensions of the graft (height, width, and length [letters "h," "w," and "l" in Figure 2A, right]) were obtained after taking into account the measurements of the sella as follows: first, a line was drawn where we expected the sellar diaphragm to be (which could be the interclinoid plane) (Figure 2A, left, thick line); then, a parallel line was drawn at the confluent point of the floor and the dorsum sellae, our point for placement of the graft (Figure 2A, left, dotted line). The dimensions of this last line had to measure the same as the length (letter "l" on Figure 2A, right) of the graft. The height of the graft (letter "h" on Figure 2A, right) matched the distance between those two parallel lines (on Figure 2A, left), but subtracting the approximate space that the elevated pituitary gland would occupy (2–3 mm). Finally, the width of the graft (letter "w" on Figure 2A, right) had to be 4 to 5 mm less than the intercarotid distance. This measurement was obtained from the coronal view of the MRI.

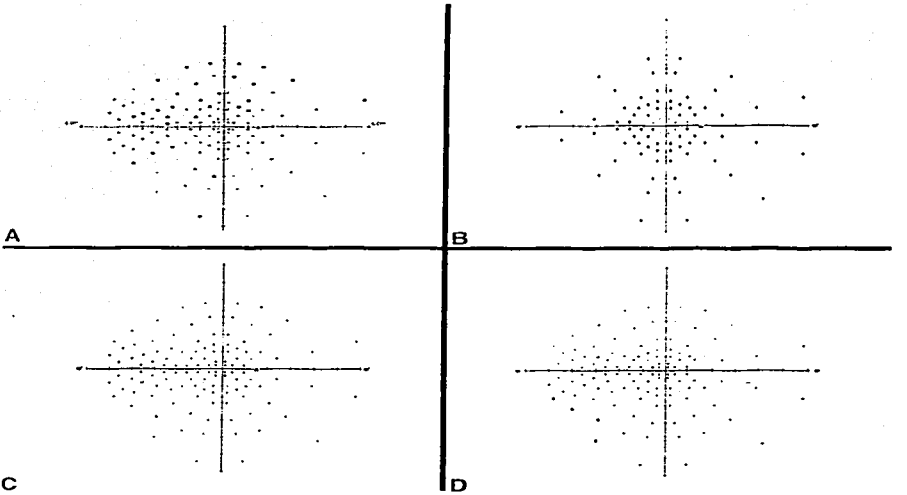
The opening of the sellar floor also had precise dimensions (Figure 2B): the transversal opening (letter "W" on Figure 2B, right) had to be 1 to 2 mm larger than the graft's width ("w"), while the vertical opening (letter "H" on Figure 2B, right) had to be slightly larger than the height ("h") of the graft. It is



2 Surgical technique. A, left: Dimensions of the sella; right: dimensions of the graft. A line was drawn on the interclinoid plane (thick line); then a parallel line was drawn on the confluent point of the floor and the dorsum sellae (dotted line). This is the site where the graft would be placed. The length of this dotted line must be similar to the length of the graft ("l"). The height of the graft ("h") matched the distance between the two parallel lines in the drawing on the left minus the approximate dimension that the elevated pituitary gland would occupy (2–3 mm). Finally, the width of the graft ("w") had to be 4 to 5 mm less than the intercarotid distance (on MRI). B, Opening of the sellar floor. Left: macroscopic view; right: microscopic view. The transversal opening ("W") was slightly larger (1–2 mm) than the width of the graft (letter "w" in Figure 2A). The vertical opening ("H") was slightly larger than the height of the graft ("h" in Figure 2A). C, Insertion of the graft. Left: Initially, the posterior end of the graft was placed at the point of union of the floor and the dorsum sellae. Right: now the anterior end was pushed gently, using a right angled curette and the aspirator. D, Final result. The structures have returned to their normal position. Left: sagittal view; right: coronal view.

important to mention that it is easier to make the opening in the sellar floor match the dimensions of the graft, because once the block was ready, its dimensions would be difficult to modify without being forced to cut the sutures. This is the reason why the initial opening of the floor must not be too wide.

The critical point was the insertion of the graft, but this was easily conducted as follows (Figure 2C): the block was first grasped with a biopsy forceps in its anterior end, and then it was introduced into the sella, initially placing its posterior end at the point of confluence of the floor and the dorsum sellae (Figure 2C, left). Then the anterior end was located using the aspirator and a right-angled curette (Figure 2C, right). If the measurements were correct, this insertion would be very simple. Once this was carried out, the anatomic structures of the sella were returned to their normal position (Figure 2D). Because of the bone plates used to form the graft, its correct location could be verified during surgery using fluoroscopy. If the position of the



3 Ophthalmologic findings. A. Preoperative right eye visual field in Case 1. B. Preoperative right eye visual field in Case 2. C. Postoperative right eye visual field in Case 1. D. Postoperative right eye visual field in Case 2.

graft was considered unsuitable, it had to be replaced. To make its extraction easier, the sutures were initially cut with a scalpel.

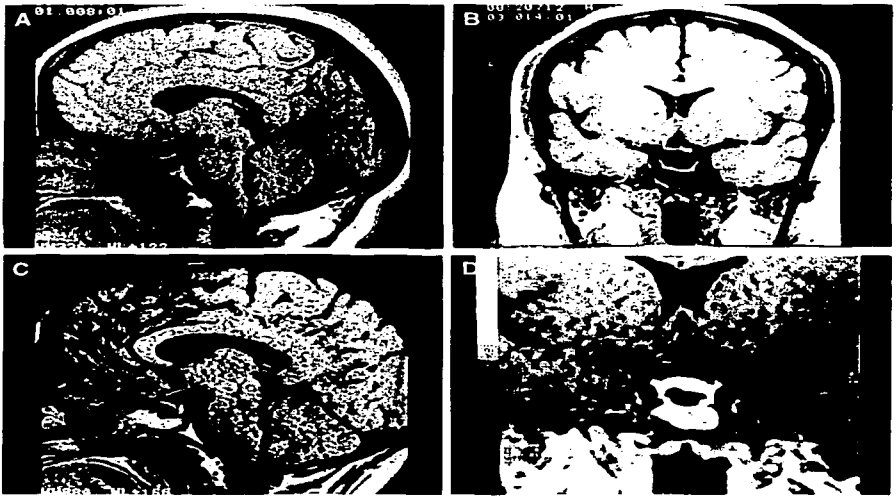
RESULTS

In both cases the visual field defects disappeared (Figure 3). It is important to mention that this improvement occurred almost immediately after surgery and has continued to date. Headaches also disappeared in Case 1. In Case 2, headaches are less intense, with a tension pattern that diminishes with anti-depressant drugs. An MRI was performed two months after the operation in both patients and repeated 2 and 5 years later, proving that the graft remained in the correct position (Figure 4). There were no complications in either patient.

DISCUSSION

Even though the term "empty sella" is the one most commonly used to refer to this clinical condition, it is well known that the term is incorrect, because in these cases the sella is not empty, but rather completely filled by the pituitary gland, with its stalk, the arachnoid, the CSF and occasionally, the optic system and the third ventricle [10,19]. This is why we would prefer to use the term proposed by Leclerq et al [11], "intrasellar arachnoidocele," because it expresses in a simple and clear way the findings in this entity. Nonetheless, because the name intrasellar arachnoidocele is not very widespread in the literature, we have used the term empty sella in this paper.

The radiologic morphology of the visual system



4 Radiologic findings (Case 2). A. Preoperative MRI, sagittal view. B. Preoperative MRI, coronal view. C. Postoperative MRI, sagittal view 5 years after surgery. The degree of elevation of the sellar contents is still adequate. D. Postoperative MRI, coronal view five years after surgery.

in both patients presented here could be considered completely normal. Kaufman et al [10] proposed a simple method to evaluate if there is herniation of the visual system toward the sella. This method is based on the recess angle (obtained from the MRI), which is formed by the posterior wall of the optic recess and the anterior wall of the pituitary recess; this angle was found to be normal in our two patients. This is why we cannot be objectively certain of the real cause of the visual deficit in these patients; however, the evident improvement in their vision after surgery supports the theory proposed by Braatvedt et al [2] and Wood et al [21], which is that in similar cases, traction of the infundibular stalk causes some microscopic anatomic alteration in the visual system or in its vascular supply, which is not evident on the imaging studies but can be reversed with surgery.

Most of the empty sella cases that need surgical treatment are operated on through a transsphenoidal approach. This procedure has been traditionally known as "chiasmapexy" [1,3–5,8,18], but this term is incorrect, because when surgery is performed through a transsphenoidal route, not only the optic system is elevated, but almost the totality of the sellar contents is as well. On the other hand, as has been shown here, not all patients with PESS have a herniation of the visual system toward the sella and so, when this procedure is conducted, the position of the optic chiasm, in some cases, does not vary. This is the reason why we agree with Olson et al [16] in referring to this kind of procedure as an "elevation of the sellar contents" instead of a "chiasmapexy."

One of the authors who has described in detail the elevation of the sellar contents in PESS is Spa-

ziante [17–19], but in our experience we have observed some technical difficulties with his suggested techniques. With the slight modification we are proposing here, this procedure becomes less complex because forming the graft block outside the surgical field is easier than doing it under the microscope. Its dimensions can be taken exactly according to the sellar shape, the elevation is very precise, and this avoids any possibility of "overpacking." Finally, because of the firm consistency of the graft, it is more manageable than fat or muscle alone.

The use of detachable vascular balloons, inserted by a transsphenoidal approach, has also been proposed to alleviate the symptoms in PESS [4,14]. With this procedure, elevation of the sellar contents can also be very precise, but it carries a higher risk of infection, is more expensive and, most troublesome, it has been reported in a long-term follow-up study that the balloons were found to be deflated [7].

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COMMENTARY

The authors describe two patients with empty sella associated with visual field deficits who showed no signs of sella arachnoiditis or displacement of the optic chiasm or nerves into the sella turcica. They theorize that the etiology is probably vascular, secondary to traction on the pituitary stalk. Each patient was treated with an extradural elevation of the intrasellar contents by the transsphenoidal approah; a detailed description of the operation is given. Both patients' visual field deficits resolved immediately after surgery and remained in remission on long-term follow-up.

We have successfully treated visual field deficits in patients with herniation of the optic chiasm and/or nerves into the sella turcica by transsphenoidal chiasmapexy. In the majority of these instances, we have encountered associated arachnoiditis. Prevention of this herniation is accom-

plished by placing fascia intradurally in the tumor bed at the original surgery.

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Despite the numerous publications on this subject, I think this paper is of interest because of the different technical approach to the elevation of the intrasellar content by the introduction of a bone graft to form two blocks around the fragment of muscle and a piece of fascia lata into the sella underneath the dura.

The pathophysiological explanation for the occurrence of secondary visual disturbance produced by the traction of the infundibulum stalk causing an anatomical alteration in the vascular supply of the optic chiasma is also interesting. However, both of these need to be confirmed in additional cases, since this report includes only two.

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All virtue is summed up in dealing justly.

—ARISTOTLE

The soul is healed by being with children.

—FYODOR DOSTOEVSKY

A genius is one who shoots at something no one else can see, and hits it.