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Ventriculovesical Shunting in a Patient with Leptomeningeal Carcinomatosis: An Alternative to VP Shunts. A Technique Report

Derivação ventriculovesical em paciente com carcinomatose leptomeníngea: Uma alternativa às DVPs. Relato de técnica

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Abstract

Leptomeningeal carcinomatosis (LC) is a rare but serious complication when cancer cells infiltrate the meninges. It is most commonly associated with breast cancer, but only 5% of breast cancer patients develop it. Leptomeningeal carcinomatosis typically presents with headaches, mainly due to hydrocephalus, and the diagnosis involves a cytological analysis of cerebrospinal fluid (CSF) and/or magnetic resonance imaging (MRI) scans. The treatment of LC consists of a combination of intra-CSF chemotherapy, systemic therapy, radiation therapy, and/or supportive care, including CSF drainage. In the case herein reported, a technique known as ventriculovesical shunting was performed on a female patient with LC and breast cancer who had hydrocephalus due to this condition. This procedure is not as common as ventriculoperitoneal shunts, which can lead, in this case, to serious complications such as peritoneal carcinomatosis.

Keywords
- meningeal carcinomatosis
- neoplasm metastasis
- hydrocephalus
- cerebrospinal fluid shunts
- neurosurgery

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Resumo

Carcinomatose leptomeníngea (CL) é uma complicação infrequente, porém séria, que ocorre quando células cancerígenas infiltram as meninges. É mais comumente associada ao câncer de mama, mas apenas 5% dos pacientes com câncer de mama a desenvolvem. A CL apresenta-se tipicamente com dores de cabeça decorrentes principalmente da hidrocefalia, e o diagnóstico envolve uma análise citológica do líquido cefalorraquidiano (LCR) e/ou ressonância magnética (RM). O tratamento da CL envolve uma combinação de quimioterapia intra-LCR, terapia sistêmica, radioterapia e/ou cuidados de suporte, incluindo a drenagem do LCR. No caso aqui relatado, realizou-se uma técnica conhecida como derivação ventriculovesical em uma paciente feminina com CL e câncer de mama que tinha hidrocefalia em decorrência desta situação. Este procedimento não é tão comum em comparação com as derivações ventriculoperitoneais, as quais, nesse caso, podem levar à carcinomatose peritoneal.

Palavras-chave

- carcinomatose meníngea
- metástase neoplásica
- hidrocefalia
- derivações do líquido cefalorraquidiano
- neurocirurgia

Introduction

Leptomeningeal carcinomatosis (LC) occurs when a solid primary tumor infiltrates the meninges, including the pia mater, arachnoid, and subarachnoid space. This rare complication of breast cancer affects approximately 5% of patients. Given the high occurrence of breast cancer globally, in terms of sheer numbers, it is the most prevalent cause of LC.[1]

Patients with LC usually have a history of cancer, and most of them have already been diagnosed with metastatic disease. The signs and symptoms commonly observed include headache (80%), nerve pain that radiates from the spine, deficiencies in cranial nerves, visual loss, loss of hearing, seizures, and a condition known as cauda equina syndrome. Nausea, vomiting, headaches that worsen with changes in position, and even drowsiness, are symptoms associated with obstructive or communicative hydrocephalus, which may affect more than half of patients with LC due to impairment of the flow of cerebrospinal fluid (CSF). An additional potential clinical manifestation is the development of a new psychiatric disorder.[2,3]

The diagnosis is confirmed through positive (malignant) CSF cytology (gold standard), radiological evidence (nodular changes on computed tomography [CT] or magnetic resonance imaging [MRI] scans) that matches clinical observations, and symptoms indicating CSF involvement in a patient who has a known malignancy.[4,5]

The primary management goals for LC are to improve the neurological function and quality of life of the patients, prevent any further deterioration of neurological symptoms, and ultimately extend their lifespan. This may include radiation therapy, the use of bevacizumab, and ventriculoperitoneal shunt placement. In numerous cases, opting for a palliative and comfort-oriented approach may be appropriate, even starting from the initial diagnosis of leptomeningeal disease.[6,7]

Regarding CSF shunts, the current body of literature describes the possibility of diversion procedures in as many as 36 different sites, including areas such as the mastoid bone, the pleura, the right atrium, the peritoneum, the urinary tract (UT), and the fallopian tubes.[8] According to the literature, the UT may be considered a potential alternative to divert the CSF when the peritoneum or atrium is unavailable.[8,9] The primary advantage of using the UT as a diversion pathway for the CSF is that it does not rely on the absorption properties of the tissue, which is a factor in the case of the peritoneum. Moreover, the choice of this anatomical site for CSF diversion is based on elimination via micturition instead of absorption.[9,10]

Case Report

A 40-year-old female patient had been under oncological follow-up for breast carcinoma for 6 months. Due to the altered level of consciousness, nausea, and vomiting, a brain MRI scan was requested, which showed diffuse leptomeningeal inflammatory tissue in the posterior fossa (►**Figure 1**) with perineural extension, as well as in the supratentorial compartment, notably in the left frontotemporal region, with mild infiltration of the parenchyma edema and

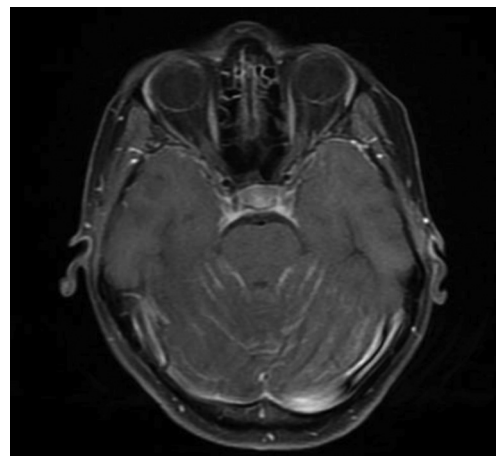

Fig. 1 Contrast-enhanced inflammatory tissue covering the leptomeningeal surface, mainly of the posterior fossa between the cerebellar folia, notably in the upper portion of the cerebellar vermis and mesencephalic aqueduct, with some areas of parenchymal infiltration causing local edema.

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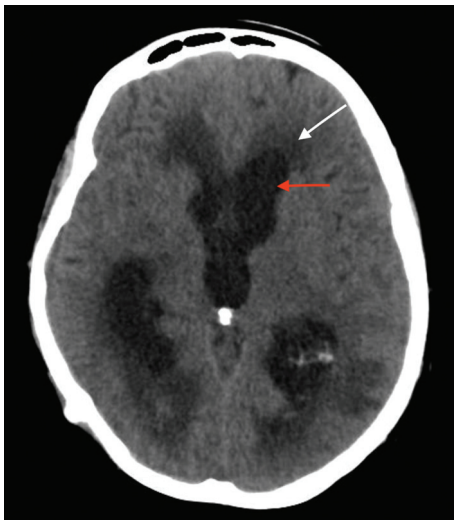

Fig. 2 Computed tomography (CT) scan showing hydrocephalus (white arrow) and transependymal edema (red arrow)

hydrocephalus (►**Figure 2**). Given the clinical context, the possibility of meningeal carcinomatosis, among other inflammatory and infectious diseases, was considered. Therefore, we decided to initiate radiation therapy.

Before the end of the radiation therapy, the patient was admitted to the emergency department with a sudden decreased level of consciousness. Thus, a brain CT scan showed supratentorial hydrocephalus and signs of transependymal transudation. Initially, external ventricular drainage was performed, and the definitive treatment was postponed until a discussion was held with the oncological team. Based on the clinical context, conditions, and prognosis, ventriculovesical shunting with the interposition of a low-pressure valve was proposed.

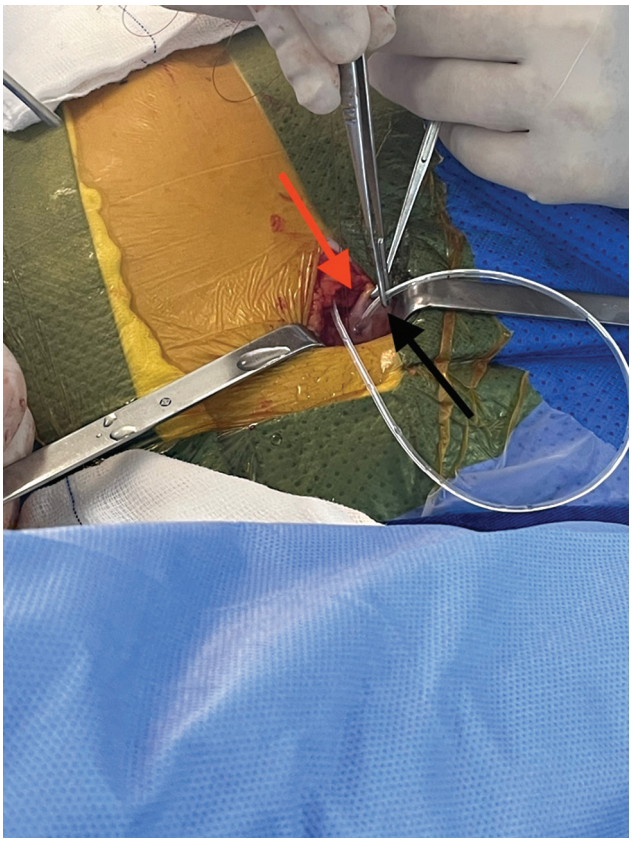

Fig. 3 A punctiform cystostomy (red arrow) is performed. The distal catheter is introduced for 7 cm to 8cm (black arrow).

Fig. 4 Abdominal CT scan (coronal view): the distal catheter inside the bladder (red arrow).

The technique for the placement of the ventriculovesical shunt follows the same principles as those of ventriculoperitoneostomy. The patient must have an indwelling urinary catheter, and it must be open. A median suprapubic incision and tunneling of the subcutaneous tissue communicate with the cranial incision. The bladder wall is identified and repaired with a catgut suture. A punctiform cystostomy is performed. The distal catheter is introduced for 7 cm to 8cm, and the repair point is used to fix the catheter on the bladder wall (►**Figure 3**). Closure is performed conventionally, with sutures in layers. For the evaluation of the correct positioning of the urinary catheter, the patient undergoes an abdominal CT (►**Figures 4** and **5**). The indwelling bladder catheter is maintained for five days.

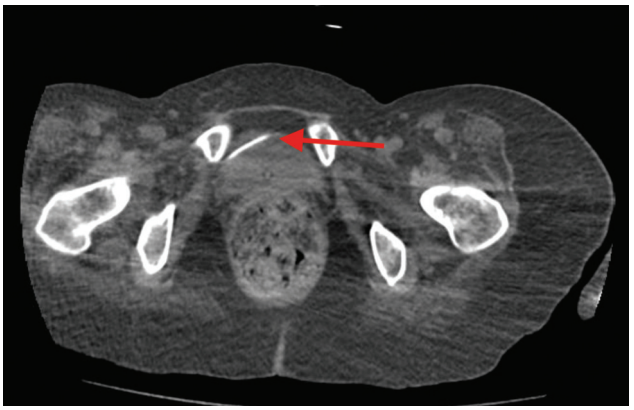

Fig. 5 Abdominal CT scan (axial view): the distal catheter inside the bladder (red arrow).

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Discussion

The clinical manifestations of meningeal carcinomatosis are vast; patients may be asymptomatic (a minority of cases), as the findings may be accidental (~ 2% of the cases), or patients may present with severe symptoms (most cases). When symptomatic, the manifestations can be systemic and non-specific, involving headache (present in 80% of the cases), alteration in the level of consciousness, nausea, and vomiting, especially in cases in which there is hydrocephalus.[1,11] In the case herein reported, the patient was symptomatic, and her clinical history corroborated the diagnostic hypothesis developed after the imaging exams.

Cases that present with hydrocephalus, are typically treated with ventriculoperitoneal or ventriculoatrial shunts; however, due to the risks of dissemination of neoplastic cells, they can be replaced by a ventriculovesical shunt.[10] The first surgery that enabled a connection between CSF and the genitourinary system was performed in 1925 by Heinle, who connected the renal pelvis to the lumbar dura mater, a urethrodural anastomosis.[12] In 1949, Matson performed what was described as a lumboureterostomy at the ureterovesical junction using a polyethylene tube. This anatomical site has a valve mechanism that prevents backward flow and consequent ascending infections, but an ipsilateral nephrectomy was required.[13]

In 1980, West[14] reported the first ventriculovesical shunting, called ventriculovesicostomy. The bladder was initially opened on its front wall, and the shunt was rerouted obliquely, positioned above and to the side of the trigone. A suture was used to attach the catheter to the back wall of the bladder via a connecting component. A significant portion of the shunt tubing, measuring 15 cm in length, was left unsecured and hanging loosely inside the bladder. The aurthor[14] reported that the complication of recurrent obstruction was relieved by urethral instrumentation.

In 2001, Ames et al.[10] developed a new method of ventriculovesicostomy without sacrificing a kidney. They altered the first procedure described by creating a distal shunt catheter using a polyester cuff, which has antibacterial properties, at the end of a silicone catheter. A nonabsorbable suture was employed to fix this apparatus onto the front wall of the bladder. The authors[10] also created a deep tunnel running along the front wall of the bladder, which was then stitched over the catheter. This addition was intended to position the shunt slightly higher towards the dome of the bladder, thereby preventing trigonal irritation. To complete the procedure, a minor incision was performed in the bladder wall to enable the introduction of the distal shunt. There were no postoperative complications during the first year of follow-up; however, they[10] highlighted the need of awareness regarding dehydration, ascending infection, and the potential formation of encrustations on the shunt tube.

Conclusion

Ventriculovesical shunting is an alternative to other CSF diversion procedures, especially when CSF absorption is not desired. This option is particularly useful in cases of LC. More studies are necessary to define the incidence of complications and reoperations in ventriculovesical shunts.

Conflict of Interests

The authors have no conflict of interests to declare.

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