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Technical notes & surgical techniques

Neurosurgical post-operative complications with incidental life-saving findings

Francesca Graziano [a,b,*], Enrico Lo Bue [a], Gianluca Scalia [b], Giuseppe E. Umana [c], Domenico G. Iacopino [a], Silvana Tumbiolo [d], Rosario Maugeri [a], Giovanni F. Nicoletti [b]

[a] Department of Biomedicine, Neurosciences, and Advanced Diagnostics, Institute of Neurosurgery, University of Palermo, Palermo, Italy
[b] Department of Neurosurgery, ARNAS Garibaldi, Catania, Italy
[c] Department of Neurosurgery, Trauma Center, Gamma Knife Center, Cannizzaro Hospital, Catania, Italy
[d] Department of Neurosurgery, Trauma Center, Villa Sofia Hospital, Palermo, Italy

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ABSTRACT

Neurosurgery is one of the most complex disciplines, requiring skillfulness and ability to try to cure nervous pathologies. Despite the role of this surgery in the inviolability of life, complications are relatively likely. Complications are frustrating and they contribute to produce a wrong but physiologic guilty conscience. However, sometimes they can have a sense over the rationale.

In our study, we present two examples of post-operative complications of common neurosurgical pathologies. We compared our experience with the complications reported in literature and analyzed the importance of seeing the patients in their entirety, so encouraging a mindful approach in our medical daily life. Mindfulness could be beneficial for both patients and physicians. A mindful patient would be more relaxed, trusty and more likely to have a better outcome; on the other hand, a mindful surgeon would be more sensitive, right and open-minded and more likely to have that brightened judgment needed in our daily mission. Thanks to this mindful, extensive approach, we could interpret that, sometimes, the following complications in a patient's surgical history are only a fraction of his life and they could have implications that neither the surgeon, nor the patient could know.

1. Introduction

The skillfulness and the ability needed in neurosurgery represent a source of inspiration for any physicians in the world. The neurosurgeon has the fine ability to touch and try to cure the crux of the human being: the central nervous system. The complex job required for this surgery results in the highest trust from the patients and their family and friends. Although the relevant role of a neurosurgeon in the inviolability of life, complications may happen and they are relatively likely [1–2].

Postoperative complications are the worst nightmare for surgeons. Sometimes they are predictable, sometimes they are not, but in both cases, they are very frustrating. However, when they happen, in the mind of the physician, begins a long and complicated journey to extrapolate the moment in which the mistake was made, a journey to find the flaw in the system. Most commonly, it is impossible to discover the error and in the majority of cases it is assumed.

The occurrence of a complication establishes a mechanism to try to solve it. Some patients seem that they are prone to develop complications over complications, contributing to produce a wrong but physiologic guilty conscience in the surgeon. It all results in a vicious circle: the physician tries to cure the patient and the patient continues to foster complications. This situation can cause exasperation and disappointment in the surgeon till the burn out or the depression, since there is not always a reason for those cursed complications and there is not always a solution for them. Or at least, that's how it looks. In our study, we present two case histories where the post operative complications allowed us to understand the importance of seeing the patients in their entirety and to encourage a mindful approach in our medical daily life.

2. Case series

2.1. Case n.1

A 65 yo male was admitted to our Neurosurgical Clinic for normal

* Corresponding author at: Department of Neurosurgery, ARNAS Garibaldi, Catania-Department of Biomedicine, Neurosciences, and Advanced Diagnostics, Institute of Neurosurgery, University of Palermo, Palermo, Italy.
E-mail address: fragraziano9@gmail.com (F. Graziano).

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pressure hydrocephalus pathology. He underwent a right frontal ventriculoperitoneal shunt. The immediate post operative outcome was uneventful. After few weeks, gait, urinary continency and cognitive performance were all, progressively, ameliorating. However, hereafter he developed a multitude of complications. For three times, with almost monthly cadency, he presented with an abdominal CSF collection due to catheter avulsion from the peritoneal cavity (Fig. 1). Each time, with a general surgeon, the peritoneal catheter was internalized and well fixed and no specific reasons for this frequent complication was identified. Then, when apparently this complication resolved, the patient presented again with a hematoma collection on the abdominal surgical site of catheter introduction. The collection didn't resolve spontaneously, so a surgical evacuation was necessary. The hematoma collection was superficial and no source of bleeding was identified. During each hospitalization, patient remained neurologically intact, maintaining benefit from the VP shunt. In the final hospitalization, he developed a superficial cutaneous surgical abdominal site infection. Aggressive antibiotic therapy was administered and, unfortunately, after few days, a mild renal insufficiency was registered. The nephrological consulting suggested a different antibiotic therapy and a kidney and urinary tract echography that revealed an incidental tiny bladder mass. After the resolution of the infection and the renal failure, the patient was discharged home and directed to the Urological Outpatient. The bladder mass biopsy demonstrated a non-muscle-invasive urothelial carcinoma. Considering the early diagnosis, a cystectomy was not recommended. Now the patient is under local urological chemotherapy. The VP shunt is working regularly and no more complications are recorded so far.

It seems plausible to assume that, probably, without the bladder echography, this neoplasm could evolve into a muscle-invasive carcinoma and the prognosis of this patient would get worse.

2.2. Case n.2

A 70 yo female, was admitted for a FBSS. The patient had undergone D12 to L3 fusion back surgery in another hospital one year earlier. In consideration of the unbearable pain of the patient, SCS implantation was performed. A tiny CSF leak complicated the post-operative course, moreover, the patient didn't benefit from the neurostimulation, so the SCS device was removed. In the surgical setting of the device removal, the dural tiny fistula was repaired. Nevertheless, the liquoral fistula didn't resolve and it infected. Rapidly, it evolved in a complex neurological syndrome compatible with encephalitis. The dural fistula was again repaired and it resolved. The encephalitis was managed and monitored with antibiotic therapy, cerebral angio-CT scan and serial contrast-enhanced MRI brain exams.

The cerebral angio-CT scan documented a large, irregular, sacculated, unrupted right MCA aneurysm (Fig. 2). After the resolution of the neurological symptoms, a specific pain therapy was suggested and the patient was discharged home and directed to a Neuroradiological Interventional Unit for the brain aneurysm embolization.

It seems plausible to assume that, probably, without the early diagnosis of the large brain aneurysm it would go to rupture leading to devastating vital consequences.

3. Discussion

The most common causes of failure reported in literature of ventriculoperitoneal shunt are represented by: mechanical shunt failures, such as obstruction in the intracranial or abdominal catheter, and abdominal injury, such as ascites, peritonitis, abdominal perforations, and volvulus [3,4,5,6,7]. Different reasons were researched in literature to explicate VPS failure. Regarding the abdominal complications, factors like obesity, previous abdominal operation, and distorted abdominal anatomy appear to be related with distal mechanical shunt failure [4,8,9,10,11]. A topical issue is the comparison between two different distal shunt placement techniques, the laparoscopic versus the open one [10–12]. In the majority of studies, laparoscopic technique demonstrates several advantages: the possibility to inspect the abdominal cavity and perform adhesiolysis, the reduction of abdominal wall trauma, the decrease of incisional hernia etc [6,11,13,14,15]. Other strategies were described in literature to reduce the abdominal complication risk, such as the subway tunneling technique, or Trocar assisted distal shunt tube insertion with intra-operative X-Ray confirmation [16,17]. Despite the active research on this field, nowadays, VPS remains a challenging procedure. As I.A. Anderson stated in a recent article regarding VPS complications, "*ventriculoperitoneal (VP) shunt failure is a source of frustration and anxiety for patients, caregivers, and neurosurgeons alike. The reason for this dissatisfaction is clear: shunt insertion is a commonly performed operation, and collectively neurosurgeons now have more than half a century of experience in performing shunt surgery, yet shunts remain as prone to failure now as they were decades ago*." [3].

The case n.1 had almost all the abdominal complications after a VPS and only when the bladder cancer diagnosis was obtained, the complications chain interrupted. Although, it might be a pure coincidence, this

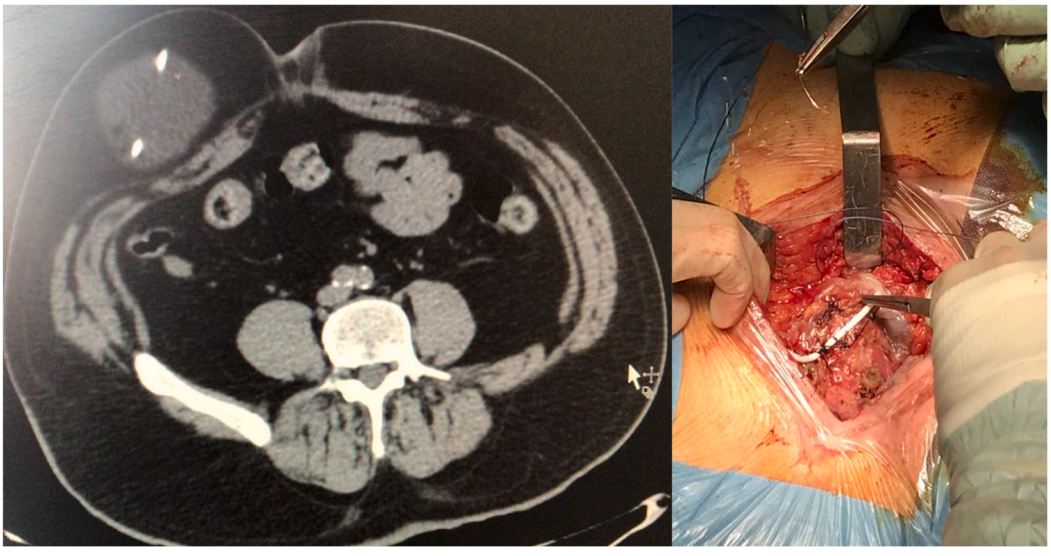

Fig. 1. A. CT Abdomen: The Pre-operative abdomen CT scan shows the CSF abdominal collection in the subcutaneous tissue, where a catheter loop is depicted. B. Intra-operative surgical image of the distal catheter shunt insertion and fixation with stiches.

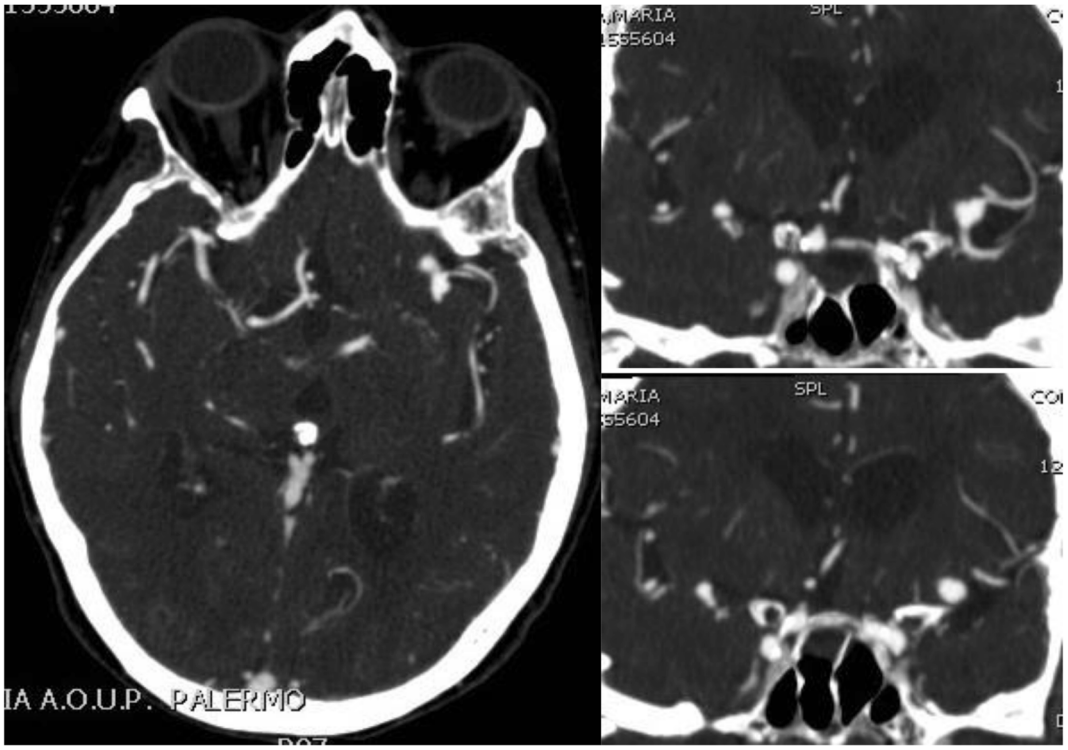

Fig. 2. CT angiography showing the large, irregular, sacculated, unrupted right MCA biforcation aneurysm

patient history triggered our sensitivity and consciousness on the importance of considering the patient in his entirety.

As well as in the case n.1. the second case, presented the most severe and unexpected complication of a SCS implant, which is, reasonably, considered a low risk, non-invasive procedure [18–19].

However, the liquoral fistula, allowed for the incidental unrupted brain aneurysm detection. Saccular unruptured intracranial aneurysms (UIAs) affect 3–5% of the adult population and are more prevalent in women than in men [20–21]. Subarachnoid hemorrhage may be the potential result of the rupture of the aneurysm and it has a poor outcome in more than 35% of patients. In the two past decades, UIAs are early identified thanks to the improvements of intracranial imaging technologies [20–21]. The increase of diagnosis has led a debate regarding the choice of the most appropriate preventive management [21–24]. The rationale to treat an UIAs is to prevent the subarachnoid hemorrhage and all the consequential complications. However, the indications to surgery should be correctly balanced between the natural course of the aneurysm and the surgical or endovascular risks [21]. The main risk factors for the aneurysm rupture are divided in two main categories: patient's factors, like hypertension, heavy alcohol use, smoking, prior SAH from other aneurysm, familial SAH, multiple aneurysm, and aneurysm's factors, like shape, size and location [25–27]. In view of the morphology and the size of the aneurysm of Case N.2 and the risks factors of the patient (age, smoking, hypertension), the multisciplinary team made by the neurosurgeon, the neuroradiologist and the anesthesiologist, agreed on a endovascular approach.

Our cases N.1 e N.2 were analyzed for weeks and discussed. We remember all the bad emotions and the discouragement for their dramatic cases, nevertheless, only looking at the patient in his entirety we realized how these events had an important role in their medical and personal life.

Clearly, not every dramatic case with complications has a final positive resolution, but at least we can still hope they do.

It's like there was a sense over the rationale, an unexpected favorable outcome. It can be compared with the butterfly effect: *"in the chaos theory, the butterfly effect is the sensitive dependence on initial conditions in which a small change in one state of a deterministic nonlinear system can result in large differences in a later state"*. [28].

3.1. The holistic view

In philosophy, the Oxford English dictionary defines holistic: "characterized by the belief that the parts of something are intimately interconnected and explicable only by reference to the whole".

In medicine, the holistic approach is: "characterized by the treatment of the whole person, taking into account mental and social factors, rather than just the symptoms of a disease".

We believe that we must not stop at the first sight; we should see the patient in all his aspects with a holistic view. Thanks to this holistic view, we could understand deeply what the patient really may need over the surgical procedure, we can interpret that the following complications in a patient surgical history are only a fraction in the life of the patient and they have implications that nobody knows, neither the surgeon, nor the patient.

The holistic view rises up our attention on the whole person and to evaluate what it's missing when managing a case, in particularly when apparently everything is done perfectly.

If at some point the surgeon had surrendered and had left the case to another surgeon, he would have never understood that sometimes the reason is hidden. A mindful surgeon should never give up in frustrating situations, instead, he should see beyond and do what is right in order to keep the physician-patient relationship. And if the surgeon perseveres doing what is right, the patient will forever be grateful despite the complications.

As told by Benzel: "*The mindful neurosurgeon has mastered the art of doing what's right. The mindful neurosurgeon does not look at a job from the perspective of the job being a commodity generator, but from the perspective of the job as a calling*". [29]

The concept of mindfulness has already been associated and used in favor to the medicine thanks to a mind–body specific therapy named "

Mindfulness-based stress reduction (MBSR)" developed by Jon Kabat-Zinn at the University of Massachusetts. It focuses on awareness and acceptance of the present condition through meditation, yoga, and exploration of behaviors and thoughts. It has been effective for both conservatively managed pain and postoperative pain in solid organ transplant recipients, breast cancer survivors, and patients with failed back surgery syndrome [30–34].

Recently, it has been demonstrated that MBSR is beneficial also in the pre-operative time in patients candidate for lumbar surgery in term of psychological and physical post-operative improvement [34].

In summary, mindfulness could be beneficial for both patient and physicians. A mindful patient would be more relaxed, trusty and positive thinking and more likely will have better outcome; as well, a mindful surgeon would be more sensitive, right and open-minded and, more likely, he will have that brightened judgment needed in our daily mission.

4. Conclusions

Postoperative complications are extremely frustrating for surgeons. However, they do exist and is part of the surgical training to learn how to manage them from both a technical and a mental point of view. Skills and experience are essential as well as a mindful patient approach to infuse faith and serenity. Looking at the patient in his whole entirety is very helpful in understanding what is missing in the management.

5. Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. The patients have given their consent for clinical information to be reported in the journal. The patients understand that their names will not be published and due efforts will be made to conceal their identity.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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