(Met) analysis of an OTONEUROSURGEON: ANTONIO MAZZONI

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Introduction

The first time I met Antonio Mazzoni I had just specialized in ENT.

I was fascinated by what I heard about his surgical skills in the skull base and the posterior fossa surgery, but at that time I did not know well what surgery of the skull base was and had probably just a slight idea of where the posterior fossa was.

Nevertheless, I applied for a fellowship in his department, at Bergamo Hospital where he was the head. It was the 2002. I remember my first talk: I had prepared my speech, repeated it to myself many times, and he said nothing. Listened, and said nothing. I tried with some questions, but he replied nothing. At the end of my monologue, where he kept on saying nothing, he asked me if I had finished. Of course, I had finished, I could not say anything more. Then he said: "There is only one thing you have to care about. The most important thing for your career and for your life is harmony. You will have to seek for harmony, every day. You will have to seek harmony between what you like, what your hopes lead you to, your work and the field you are involved in, and the price that everything will cost to you. The skull base surgery is a difficult surgery, but difficult surgery is to be transformed into a series of easy steps. The point is to know what these steps are, and how difficult surgery can be shifted to series of plain precise, simple, surgical acts. And we must always know what we are doing, the consequences that doing differently may involve, and face them. These steps are to be learned, understood, performed, and always respected, even when you feel you are at ease with them. We are nothing more than good artisans, we try to act as good artisans: do with our hands, at our best, what our head is driving us to do."

This was, and is, extraordinarily true.

"The big difference between what the skull base surgery was for the surgeons of our generation" -he trained in Los Angeles, with the pioneers of the House Clinic and then came back to Italy with new surgical approaches through the temporal bone to be applied and performed for the tumors of the posterior fossa, internal auditory canal, jugular foramen and petrous bone- "the big difference was that we were experiencing and pushing forward something new, new surgical approaches what we were studying and trying in the dissection laboratories. There were neither *previous* experiences, reports or series with tips and tricks on how to perform surgery, nor *previous* surgical refinements to perform better surgery and reduce the surgical morbidity. Before the advent of the lateral approaches to the skull base, where the otologist's' community played a great role, morbidity of posterior fossa surgery was higher. The drill, the microscope, the possibility of doing microsurgery were the new tools which our generation relied on. Now the situation is different, I would dare say: you have teachers, and technology, but you need strength, humility, willingness, years of studying and training as well as enduring the long-lasting learning curve."

The thing I know better of him (...beyond his two favorite books, "The world of yesterday" by Stefan Zweig and "Memoirs of Hadrian" by Marguerite Yourcenar) is his own way of being a teacher. He never tells you what you have to do but asks you *which* the goal is of what you are doing, or why you are doing so and not differently. He tries to give the instruments through which one can make his/her own idea, his/her own judgement.

This is the **introduction**.

Material and methods are the interview that Giulia Tealdo and I made to him. A vocal record was obtained, without any prospective informed consensus … it was released retrospectively. Then everything was carefully reported.

Results are questions and answers.

Discussion and conclusion: see over.

Methods and Results

Why are you so concerned in hearing preservation surgery (HPS) in vestibular schwannoma (VS)? And when did all start?

"To the best of our knowledge, it began with a paper by two American neurosurgeons in 1954 (Elliott and McKissock), who removed three VS (two 1 cm and one 1.5 cm size), by retrosigmoid (RS) approach, for which they presented the audiological outcomes. In 1954 they didn't use the microscope, nor they had any idea on how to open the internal auditory canal (IAC); this report seems difficult to trust, but it may be an anecdotal report of VS removal and hearing preservation. The story goes on with a few cases of neuroma removed in the 1960s by middle fossa (MF) approach by William House. At the end of the 1970s, neurosurgeons began to remove VSs with preservation of hearing. The first paper where hearing preservation surgery began to be reported, is from Smith in 1973, who presented his case series 10 years later. In the meantime, Bremond and many others started.

In 1988 an otolaryngologist did a review paper, with a substantial number of cases without audiological status and postsurgical outcomes; however, of the 395 cases with reported audiological data, hearing was preserved in 33% of cases.

I started in 1976, with neurosurgeon Giorgio Valentini in Ferrara, after about 4 years of experience with translabyrinthine approach for VS resection. In that year, I began to experience the retrolabyrinthine meatotomy, which was embryo-shaped if compared to todays. Starting with the RS approach in an ENT Department, it was a long and difficult process, also because the results took some time to be evident. Hearing was evaluated after a month postoperatively, and the completeness of the resection, i.e., the absence of residual disease, required years to be assessed. Besides, the otoneurosurgeon is in principle rather a lonely surgeon, his/her items are hardly understood by the ENT colleagues. Surgeons who are involved in VS surgery, claim in principle to do HPS, but the rarity of cases (for intrinsic reasons) and the slow improvement in results are some of the reasons why the learning path in this surgery is difficult and, not unfrequently, abandoned.

Nevertheless, it is anachronistic not to care about hearing preservation in the present days of early diagnosis of VS and leaving to the natural course of the disease the fate of hearing, is somewhat to give up a priori to the progress of therapy.

After the first experiences, we realized that the best success rate in hearing preservation was possible for small tumors with good preoperative hearing. From 1990 to 2000, HPS became fashionable and all the otoneurosurgeons believed they could switch to HPS, but they were unprepared. They switched to HPS but did not accept the difficulty of learning. For this reason, in those years many articles were published on HPS reporting poor results, advising against this technique (the most expressive titles said 'Myth or reality', 'The hidden truth in the preservation of hearing', and so on), and the drop of HPS was stated. Interestingly, their case material included the obvious fact of good results in small tumors with good hearing.

Why couldn't they get good results? First, because it's a difficult surgery, preserving the cochlear nerve is much harder than preserving the facial nerve, and they didn't have the willingness to learn. We do not deal with young surgeons, but with experienced surgeons, who had already achieved good results with the translabyrinthine approach; HPS was like a new path, and it was not easy to face it as sort of beginners.

Moreover, hearing preservation is the result not only of the direct effect of surgery, but also of a series of mechanisms we don't know yet, or which we don't have full control over (typically, the item of nerve ischemia and the vasospasm of the labyrinthine arteries,

the internal auditory artery being rarely exposed).

So, the awareness of a long learning curve and lack of case selection (based on tumor size, Pure Tone Average and Auditory Brainstem Response), led to a skeptical stance towards HPS. In the last decade, the assumption that a consistent number of tumors do not grow, offered the reason to abstain from surgically removing small tumors with good hearing. This involved good rates of disease control, but over the long term, it involved patient's deafness and no progress in hearing preservation therapy.

Even today, HPS has a poor appeal on ENT surgeons, who are conditioned by the most influential Centers that have abandoned this surgery, and, curiously, have concentrated on straight hearing rehabilitation with cochlear implant. This is due, in addition to the reasons already mentioned, to the fact that this surgery costs 3 times more than the removal by translabyrinthine approach of the same tumor. So, early translabyrinthine surgery with preservation of the cochlear nerve is preferred to the attempt of natural hearing preservation. I think the faculty to know about this alternative approach should be given to the patient, so that he/she can decide once informed of all the options. It happens often that if a surgeon has poor results with HPS, dissuades patients from doing it, or describes it as dangerous or ineffective".

Which are the cornerstones of HPS today?

"Today's surgery is based on a good preservation of the cochlear nerve (which is fit to receive cochlear implant, if necessary), and this can be obtained: i) when the nerve is not too much altered by the tumor, as in case of good preoperative hearing and small size; ii) with intraoperative monitoring of the function of the cochlear nerve, that drives the surgeon during the dissection of the tumor and warns when it is time to stop and allow the nerve to recover, before continuing with the maneuvers. Neurophysiologists are more and more absent in the neurological setting and intraoperative monitoring is knowing a crisis. The limit of monitoring is the slow, cumulative damage to the nerve. The electrode is a very cheap tool to record the cochlear nerve action potential (CNAP), so there is no interest to develop better tools. The ideal solution would be to put the electrode directly on the cochlear nuclei, but the problem is that, to use these electrodes, you have to buy the whole recording device, which is very expensive".

Which are the critical aspects of the learning path in skull base surgery for a young specialist?

"Schools of specialization in Italy are not frequently accompanied by education in surgery and the young ENT surgeon learns to practice in-vivo what should have learned on cadavers. I doubt that things are changing now; too many schools of specialization do not have a dissection lab.

The surgeon should begin a skull base learning path when is familiar with middle ear and neck surgery. The work that an expert otoneurosurgeon is required to do over the years to become autonomous and experienced is so hard that he/she often sees in the apprentice a potential competitor and does not teach skills. I also took the specialization without anyone teaching me how to do a tonsillectomy. Fortunately, I spent 2-3 years in a small hospital to learn Medicine first and then in lab research doing microdissection on temporal bones. That way I could learn: i) the ability to use the microscope, ii) the skills to manipulate the instruments and iii) three-dimensional learning of the temporal bone and CPA anatomy.

A basic step in the training of an otoneurosurgeon today is the opportunity to practice with a mentor who points out the mistakes and key points of each surgical step. The mentor stays close to the young surgeons, looks after so that the surgical morbidity is not worsened by any mistake, and in crucial points can operate so that the young surgeon can understand (and next time repeat) what he/she is doing".

Which are the fundamental concepts in lateral skull base microsurgery?

1)"Microsurgery of the skull is based on a conical corridor with a wide entrance door, which is widened not only to give space to the instruments, but also because, varying the

obliquity of the vision, you can center on your surgical target.

2) Another important thing is the correct ergonomics, which allows the surgeon to act fluently without directing his attention on his hands. The ergonomic position means sitting and not standing, feet firmly placed on the floor, without the need to play the drill pedal, with the elbow and forearm leaning against the patient, so that the movements of the wrist, hand and fingertips are free. If you're too far away from the patient and you're somehow suspended, you are unable to make the necessary movements and you get tired. This ergonomics is currently neglected by the modern microscopes: in the new models, the distance between the head of the patient and the surgeon's eyes is such as to prevent any ease of movement. And that's a problem if the microscope is too long. The long microscopes with plenty of functions paralyzed arms and mind of a full generation of surgeons".

How should malignant tumors of the lateral skull base be approached?

"When a surgeon deals with a cancer of the petrous bone, if he/she doesn't have an oncological background and is not involved in surgery of the temporal bone, he/she'll be in trouble. The otologist, who is able to deal with the temporal bone, has often no knowledge of cancer and oncological principles. Performing surgery in the temporal bone and adjacent areas (pinna, parotid, periauricular tissues, parapharyngeal space) is a difficult task and requires study and practice.

First, a malignant tumor should be removed en-bloc with healthy tissue around it to reduce the risk of recurrence, not differently from what happens in head and neck surgery. This is difficult because the temporal bone contains vital structures (vessels and nerves), the tumor crosses the bone to reach the adjacent tissues and behaves differently in each tissue it is contact with. Since the surgeon has to deal with different tissues in a very limited space, he/she needs different surgical skills. Thus, a malignant tumor is often removed in pieces, not differently from what the otologist does with cholesteatoma or polyps. And the head and neck surgeons, on their part, do not enlarge the resection considering the skull base a barrier to the tumor; on the contrary, skull base is a path of diffusion and should be managed with oncological principles of extended resection in healthy tissues. En-bloc resection of malignant advanced tumors of the temporal bone means separating the temporal bone from the dura and from the carotid and removing all together. The management of cancer in the temporal bone suffers from years of no-research, or of little research, because otologists know too little of cancer, and the head-neck surgeons know too little of the temporal bone. Should we mention how general otologist has a development standstill due to almost absent research? "

Discussion and conclusion

"In the past, surgery was described as an art, the technique was not taught, and young surgeons had to learn by themselves on patients and not in anatomical specimens or cadavers. Also today, surgery is not the goal of education, even though we know well how to teach it. The young surgeon has to rely mainly on himself and hope to find an able mentor, that performs surgical procedures in an understandable manner. Moreover, "the surgical schools" are not used to have a tutor supervising and leading the education of the young, and there is not an effective assessment of the standards achieved by the new specialists.

Surgery is not an art for few "enlightened", it is nothing more than good craftsmanship that, like children with the bike, the early is learnt, the better."

Prof. Antonio Mazzoni in Los Angeles