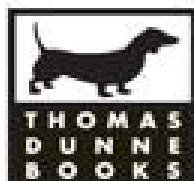


# DO NO HARM

STORIES OF LIFE, DEATH,  
AND BRAIN SURGERY

HENRY MARSH



# DO NO HARM

STORIES OF LIFE, DEATH,  
AND BRAIN SURGERY

HENRY MARSH



The author and publisher have provided this e-book to you for your personal use only. You may not make this e-book publicly available in any way. **Copyright infringement is against the law. If you believe the copy of this e-book you are reading infringes on the author's copyright, please notify the publisher at:** [us.macmillanusa.com/piracy](http://us.macmillanusa.com/piracy).

# Contents

*Title Page*

*Copyright Notice*

*Dedication*

*Epigraph*

*Preface*

1. Pineocytoma
2. Aneurysm
3. Haemangioblastoma
4. Melodrama
5. Tic douloureux
6. Angor animi
7. Meningioma
8. Choroid plexus papilloma
9. Leucotomy
10. Trauma
11. Ependymoma
12. Glioblastoma
13. Infarct
14. Neurotmesis
15. Medulloblastoma
16. Pituitary adenoma
17. Empyema

18. Carcinoma
19. Akinetic mutism
20. Hubris
21. Photopsia
22. Astrocytoma
23. Tyrosine kinase
24. Oligodendroglioma
25. Anaesthesia dolorosa

*Acknowledgements*

*Copyright*

For Kate, without whom this book would never have been  
written

'First, do no harm...'

Commonly attributed to Hippokrates of Kos, c. 460 BC

'Every surgeon carries within himself a small cemetery, where from time to time he goes to pray – a place of bitterness and regret, where he must look for an explanation for his failures.'

René Leriche, *La philosophie de la chirurgie*, 1951

# PREFACE

Throughout my career I have been fortunate to work with colleagues from America—mainly neurosurgical residents who come to work for one year in my department in London as part of their training. I have learned much from them and as with many Brits who have worked with Americans I love their optimism, their faith that any problem can be solved if enough hard work and money is thrown at it, and the way in which success is admired and respected and not a cause for jealousy. This is a refreshing contrast to the weary and knowing skepticism of the English. Yet when I visit American hospitals and see the extremes to which treatment can sometimes be pushed, I wonder whether the doctors and patients there have yet to understand that the famous dictum that in America death is optional, was meant as a joke.

I have also worked in countries such as Ukraine and Sudan that have very impoverished health care systems compared to America. You realize quite quickly, however, that despite the very great differences in equipment and technology many things are the same. Our vulnerability and fear of death when we are patients know no national boundaries, and the need for honesty and kindness from doctors—and the difficulty at times in giving these—is equally universal. I would hope that my many American trainees have come to understand this by working in the foreign country that is England, just as I have done with my work abroad.

Doctors will sometimes admit their mistakes and “complications” to each other but are reluctant to do so in public, especially in countries that have commercial, competitive healthcare systems. This book is as much



about failure as success, but it is not intended as a confession and instead is an attempt to give an honest account of what it is like to be a neurosurgeon. My readiness to admit to my fallibility is perhaps rather English, but I hope that the problems I describe will be familiar to doctors and patients everywhere. The book is also the story of an all-encompassing love affair, and an explanation of why it is such a privilege—although a very painful one—to be a neurosurgeon.

—Henry Marsh, August 2014

## PINEOCYTOMA

*n.* an uncommon, slow-growing tumour of the pineal gland.

I often have to cut into the brain and it is something I hate doing. With a pair of diathermy forceps I coagulate the beautiful and intricate red blood vessels that lie on the brain's shining surface. I cut into it with a small scalpel and make a hole through which I push with a fine sucker – as the brain has the consistency of jelly a sucker is the brain surgeon's principal tool. I look down my operating microscope, feeling my way downwards through the soft white substance of the brain, searching for the tumour. The idea that my sucker is moving through thought itself, through emotion and reason, that memories, dreams and reflections should consist of jelly, is simply too strange to understand. All I can see in front of me is matter. Yet I know that if I stray into the wrong area, into what neurosurgeons call eloquent brain, I will be faced by a damaged and disabled patient when I go round to the Recovery Ward after the operation to see what I have achieved.

Brain surgery is dangerous, and modern technology has only reduced the risk to a certain extent. I can use a form of GPS for brain surgery called Computer Navigation where, like satellites orbiting the Earth, infra-red cameras face the patient's head. The cameras can 'see' the instruments in my hands which have little reflecting balls attached to them. A computer connected to the cameras then shows me the position of my instruments in my patient's brain on a scan done shortly before the operation. I can operate with the patient awake under local anaesthetic so that I can identify the eloquent areas of the brain by stimulating the brain

with an electrode. The patient is given simple tasks to perform by my anaesthetist so that we can see if I am causing any damage as the operation proceeds. If I am operating on the spinal cord – which is even more vulnerable than the brain – I can use a method of electrical stimulation known as evoked potentials to warn me if I am about to cause paralysis.

Despite all this technology neurosurgery is still dangerous, skill and experience are still required as my instruments sink into the brain or spinal cord, and I must know when to stop. Often it is better to leave the patient's disease to run its natural course and not to operate at all. And then there is luck, both good luck and bad luck, and as I become more and more experienced it seems that luck becomes ever more important.

\* \* \*

I had a patient to operate on with a tumour of the pineal gland. In the seventeenth century the dualist philosopher Descartes, who argued that mind and brain are entirely separate entities, placed the human soul in the pineal gland. It was here, he said, that the material brain in some magical and mysterious way communicates with the mind and with the immaterial soul. I don't know what he would have said if he could have seen my patients looking at their own brains on a video monitor, as some of them do when I operate under local anaesthetic.

Pineal tumours are very rare. They can be benign and they can be malignant. The benign ones do not necessarily need treatment. The malignant ones can be treated with radiotherapy and chemotherapy but can still prove fatal. In the past they were considered to be inoperable but with modern, microscopic neurosurgery this is no longer the case. It is usually now thought necessary to operate at least to obtain a biopsy and confirm the type of tumour so that you can decide how best to treat the patient. The pineal is buried deep in the middle of the brain so the operation is, as surgeons say, a challenge. Neurosurgeons look at brain scans showing pineal tumours with both fear and excitement, like mountaineers looking up at a great peak that they hope to climb.

This particular patient had found it very hard to accept that he had a life-threatening illness and that his life was now out of his control. He was a high-powered company director. He had thought that the headaches which had started to wake him at night were caused by the stress of having had to sack so many of his employees in the aftermath of the financial crash of 2008. It turned out that he had a pineal tumour and acute hydrocephalus. The tumour was obstructing the normal circulation of cerebro-spinal fluid around his brain and the trapped fluid was increasing the pressure in his head. Without treatment he would go blind and die within a matter of weeks.

I had had many anxious conversations with him over the days before the operation. I explained that the risks of surgery, which included death or a major stroke, were ultimately less than the risks of not operating. He laboriously typed everything I said into his smartphone, as though typing down the long words – obstructive hydrocephalus, endoscopic ventriculostomy, pineocytoma, pineoblastoma – would somehow put him back in charge and save him. His anxiety, combined with my feeling of profound failure about an operation I had carried out a week earlier, meant that I faced the prospect of operating upon him with dread.

I had seen him the night before the operation. When I talk to my patients the night before surgery I try not to dwell on the risks of the operation ahead, which I will already have discussed in detail at an earlier meeting. I try to reassure them and lessen their fear, although this means that instead I make myself more anxious. It is easier to carry out difficult operations if you have told the patient beforehand that the operation is terribly dangerous and quite likely to go wrong – I will perhaps then feel a little less painfully responsible if it does.

His wife was sitting beside him looking quite sick with fear.

‘This is a straightforward operation,’ I reassured them, with false optimism.

‘But the tumour could be cancerous, couldn’t it?’ she asked.

A little reluctantly I said that it might be. I explained that I would get a frozen section during the operation – a specimen to be examined

immediately by a pathologist. If he reported that the tumour was not cancerous I would not have to try to get every last little bit of tumour out. And if it was a tumour called a germinoma I wouldn't have to remove it at all and her husband could be treated – and probably cured – with radiotherapy.

‘So if it's not cancer and not a germinoma then the operation is safe,’ she said, but her voice tailed off uncertainly.

I hesitated, not wanting to frighten her. I chose my words carefully. ‘Yes – it makes it a lot less dangerous if I don't try to take it all out.’

We talked for a little longer before I wished them good night and went home.

\* \* \*

Early the next morning I lay in bed thinking about the young woman I had operated on the previous week. She had had a tumour in her spinal cord, between the sixth and seventh cervical vertebrae, and – although I do not know why, since the operation had seemed to proceed uneventfully – she awoke from the operation paralysed down the right side of her body. I had probably tried to take out too much of the tumour. I must have been too sure of myself. I had been insufficiently fearful. I longed for this next operation, the operation on the pineal tumour, to go well – for there to be a happy ending, for everybody to live happily ever after, so that I could feel at peace with myself once again.

But I knew that however bitter my regret, and however well the pineal operation went, nothing I could do would undo the damage that I had done to the young woman. Any unhappiness on my part was nothing compared to what she and her family were going through. There was no reason for this next operation on the pineal tumour to go well just because I hoped so desperately that it would, or because the previous operation had gone so badly. The outcome of the pineal operation – whether the tumour was malignant or not, whether I could remove the tumour or whether it was hopelessly stuck to the brain and everything went horribly wrong – was largely outside my control. I also knew that

as time went by the grief I felt at what I had done to the young woman would fade. The memory of her lying in her hospital bed, with a paralysed arm and leg, would become a scar rather than a painful wound. She would be added to the list of my disasters – another headstone in that cemetery which the French surgeon Leriche once said all surgeons carry within themselves.

As soon as an operation begins, I usually find that any such morbid fear disappears. I take up the scalpel – no longer from the scrub nurse's hand but, in accordance with some Health and Safety protocol, from a metal dish – and, full of surgical self-confidence, press it precisely through the patient's scalp. As the blood rises from the wound the thrill of the chase takes over and I feel in control of what is happening. At least, that is what usually happens. On this occasion the disastrous operation of the preceding week meant that I came to the theatre suffering from severe stage fright. Instead of chatting as I usually do with the scrub nurse and Mike, one of the trainee surgeons known as specialist registrars who was assisting me, I cleaned the patient's skin and positioned the drapes in silence.

Mike had been working with me for some months and we knew each other well. I must have trained many registrars over the thirty years of my career and with most of them, I would like to think, I have got on well. I am there to train them, and must take responsibility for what they do, but they in turn are there to assist and support me and, when necessary, encourage me. I know well enough that they will usually only tell me what they think I want to hear, but it can be a very close relationship – a little, perhaps, like that between soldiers in battle – and it is what I will miss most when I retire.

'What's up, Boss?' Mike asked.

I grunted through my face mask.

'The idea that neurosurgery is some kind of calm and rational appliance of science,' I said, 'is such utter crap. At least it is for me. That bloody operation last week makes me feel as nervous as I was thirty years ago and not at all as though I was approaching retirement.'

‘Can’t wait,’ said Mike – a standard joke the bolder of my registrars will make now that I am reaching the end of my career. There are currently more trainees than there are consultant jobs and my trainees all worry about their future. ‘Anyway, she’ll probably get better,’ he added ‘It’s early days.’

‘I doubt it.’

‘But you never know for certain...’

‘Well, I suppose that’s true.’

We were standing behind the patient as we talked, since the unconscious, anaesthetized man was propped upright in the sitting position. Mike had already shaved a narrow strip of hair away from the back of his neck.

‘Knife,’ I said to Agnes the scrub nurse. I took it from the dish she held out to me and quickly cut down through the back of the man’s head. Mike used a sucker to clear the blood away and I then split the neck muscles apart so that we could start drilling through the bone of his skull.

‘Really cool,’ said Mike.

The man’s scalp incised, the muscles retracted, a craniectomy of the skull performed, the meninges opened and reflected – surgery has its own ancient descriptive language – I had the operating microscope brought in and I settled down in the operating chair. With a pineal operation, unlike other brain tumours, you do not need to cut through the brain to reach the tumour; instead, once you have opened the meninges, the membrane beneath the skull that covers the brain and spinal cord, you are looking along a narrow crevice that separates the upper part of the brain, the cerebral hemispheres, from the lower part – the brainstem and cerebellum. You feel as though you are crawling along a long tunnel. At about three inches’ depth – although it feels a hundred times longer because of the microscope’s magnification – you will find the tumour.

I am looking directly into the centre of the brain, a secret and mysterious area where all the most vital functions that keep us conscious and alive are to be found. Above me, like the great arches of a cathedral roof, are the deep veins of the brain – the Internal Cerebral Veins and

beyond them the basal veins of Rosenthal and then in the midline the Great Vein of Galen, dark blue and glittering in the light of the microscope. This is anatomy that inspires awe in neurosurgeons. These veins carry huge volumes of venous blood away from the brain. Injury to them will result in the patient's death. In front of me is the granular red tumour and beneath it the tectal plate of the brainstem, where damage can produce permanent coma. On either side are the posterior cerebral arteries which supply the parts of the brain responsible for vision. Ahead, beyond the tumour, like a door opening into a distant white-walled corridor once the tumour has been removed, is the third ventricle.

There is a fine, surgical poetry to these names which, combined with the beautiful optics of a modern, counter-balanced microscope, makes this one of the most wonderful of neurosurgical operations – if all goes well, that is. On this occasion as I approached the tumour there were several blood vessels in the way that had to be cut – you need to know which can be sacrificed and which cannot. It was as though I had lost all my knowledge and experience. Every time I divided a blood vessel I shook a little with fright, but as a surgeon you learn at an early stage of your career to accept intense anxiety as a normal part of the day's work and to carry on despite it.

An hour and a half into the operation I reached the tumour. I removed a minute fragment to be sent off to the pathology laboratory and I leaned back in my operating chair.

'We'll now have to wait,' I said to Mike with a sigh. It is not easy to break off in the middle of an operation and I sat slumped in my chair, nervous and tense, longing to get on with the operation, hoping that my pathology colleague would report the tumour to be both benign and operable, hoping that the patient would live, hoping that I would be able to tell his wife after the operation that all would be well.

After forty-five minutes I could not stand the delay any longer, pushed my chair away from the operating table and leapt out of it to go to the nearest phone, still in my sterile gown and gloves. I rang the path



lab and demanded to speak to the pathologist. There was a brief delay and he came to the phone.

‘The frozen!’ I shouted ‘What’s happening?’

‘Ah,’ said the pathologist, sounding quite imperturbable. ‘So sorry about the delay. I was in another part of the building.’

‘What the hell is it?’

‘Yes. Well, I’m looking at it now. Ah! Yes, it looks like a straightforward benign pineocytoma...’

‘Wonderful! Thank you!’

Instantly forgiving him, I went back to the operating table where everybody was waiting.

‘Let’s get on with it!’

I scrubbed up again and climbed back into my operating chair, settled my elbows on the armrests and got back to work on the tumour. Each brain tumour is different. Some are as hard as rock, some as soft as jelly. Some are completely dry, some pour with blood – sometimes to such an extent that the patient can bleed to death during the operation. Some shell out like peas from a pod, others are hopelessly stuck to the brain and its blood vessels. You can never know for certain from a brain scan exactly how a tumour will behave until you start to remove it. This man’s tumour was, as surgeons say, cooperative and with a good surgical plane – in other words, it was not stuck to the brain. I slowly cored it out, collapsing the tumour in on itself away from the surrounding brain. After three hours it looked as though I had got most of it out.

Since pineal tumours are so rare one of my colleagues came into my theatre from his own operating theatre, to see how the operation was going. He was probably a little jealous.

He peered over my shoulder.

‘Looks OK.’

‘So far,’ I said.

‘Things only go wrong when you’re not expecting them,’ he replied as he turned to go back to his own theatre.

\* \* \*

The operation continued until I had removed all of the tumour without injuring any of the surrounding vital architecture of the brain. I left Mike to close the wound and walked to the wards. I had only a few in-patients, one of them the young mother I had left paralysed a week earlier. I found her on her own in a side-room. When you approach a patient you have damaged it feels as though there is a force-field pushing against you, resisting your attempts to open the door behind which the patient is lying, the handle of which feels as though it were made of lead, pushing you away from the patient's bed, resisting your attempts to raise a hesitant smile. It is hard to know what role to play. The surgeon is now a villain and perpetrator, or at best incompetent, no longer heroic and all-powerful. It is much easier to hurry past the patient without saying anything.

I went into the room and sat down in the chair beside her.

'How are you?' I asked lamely.

She looked at me and grimaced, pointing wordlessly with her good left arm to her paralysed right arm and then lifting it up to let it fall lifeless onto the bed.

'I've seen this happen after surgery before, and the patients got better, although it took months. I really do believe you will get largely better.'

'I trusted you before the operation,' she said. 'Why should I trust you now?'

I had no immediate reply to this and stared uncomfortably at my feet.

'But I believe you,' she said after a while, although perhaps only out of pity.

I went back to the theatres. The pineal patient had been transferred from the table to a bed and was already awake. He lay with his head on a pillow, looking bleary-eyed, while one of the nurses washed the blood and bone dust left from the operating out of his hair. The anaesthetists and theatre staff were laughing and chatting as they busied themselves

around him, rearranging the many tubes and cables attached to him, in preparation for wheeling him round to the ITU. If he had not woken up so well they would have been working in silence. The nurses were tidying the instruments on the trolleys and stuffing the discarded drapes and cables and tubes into plastic rubbish bags. One of the porters was already mopping the blood off the floor in preparation for the next case.

‘He’s fine!’ Mike happily shouted to me across the room.

I went to find his wife. She was waiting in the corridor outside the ITU, her face rigid with fear and hope as she watched me approach her.

‘It went as well we could hope,’ I said, in a formal and matter-of-fact voice, playing the part of a detached and brilliant brain surgeon. But then I could not help but reach out to her, to put my hands on her shoulders, and as she put her hands on mine and we looked into each other’s eyes, and I saw her tears and had to struggle for a moment to control my own, I allowed myself a brief moment of celebration.

‘I think everything’s going to be all right,’ I said.

## ANEURYSM

*n.* a morbid dilatation of the wall of a blood vessel, usu. an artery.

Neurosurgery involves the surgical treatment of patients with diseases and injuries of the brain and spine. These are rare problems so there are only a small number of neurosurgeons and neurosurgical departments in comparison to other medical specialties. I never saw any neurosurgery as a medical student. We were not allowed into the neurosurgical theatre in the hospital where I trained – it was considered too specialized and arcane for mere students. Once, when walking down the main theatre corridor, I had had a brief view through the small port-hole window of the neurosurgical theatre's door of a naked woman, anaesthetized, her head completely shaven, sitting bolt upright on a special operating table. An elderly and immensely tall neurosurgeon, his face hidden by a surgical facemask and a complicated headlight fixed to his head, was standing behind her. With enormous hands he was painting her bare scalp with dark brown iodine antiseptic. It looked like a scene from a horror film.

Three years later I found myself in that same neurosurgical operating theatre, watching the younger of the two consultant neurosurgeons who worked in the hospital, operating on a woman with a ruptured cerebral aneurysm. I had been qualified as a doctor for one and a half years by then and was already disappointed and disillusioned with the thought of a career in medicine. I was working at the time as a senior house officer, or SHO for short, in my teaching hospital's intensive care unit. One of the anaesthetists who worked on the ITU, seeing that I looked a little