Neurosurgical Classic—XXVIII

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The prognosis of patients with intracranial neoplasms has steadily improved since the first attempts at their removal were made in the nineteenth century.\(^5\)\(^6\) Much of this progress has been attributed to the introduction of modern diagnostic procedures and the development of supportive techniques such as the transfusion of blood and the administration of antibiotics and intravenous fluids. But the greatest single contribution to the improvement in the prognosis of these patients was made by Harvey Cushing when he introduced the principles and standardized the techniques of meticulous cerebral surgery.\(^2\)\(^5\)\(^6\)

The early operations for brain tumors

"... were all done by general surgeons who had no training or experience in brain surgery and no special interest in it; they simply felt compelled 'to do a brain case' and report it in order 'to keep up with Jones.' One unhappy experience usually sufficed to rid the general surgeon of his compulsion to be a 'brain surgeon,' and only the rare individuals let themselves in for another similar experience. A survey of the Surgeon General's Index Catalogue for the years 1886 to 1896 revealed the amazing fact that during the 10 year period immediately following the successful removal of a brain tumor by Horsley, more than 500 different general surgeons reported operations performed upon the brain! The fact that in the next 10 years from 1896 to 1906 the number of surgeons reporting cases had fallen to less than 80 reflected discouragement and a beginning return to sanity. ..."\(^4\)

Dr. Philip C. Knapp, a leading neurologist at the turn of the century, was one of several observers who collected the results of these early operations for brain tumors.\(^3\)\(^5\)\(^6\)\(^7\)\(^8\)\(^9\)\(^10\)\(^11\)\(^12\)\(^13\)\(^14\)\(^15\)\(^16\) By 1906,

"... he was able to see some improvement, due he says to the improvement in surgical technic, but even so the results were far from encouraging. In this final report Knapp was able to collect from the literature 838 cases of brain tumor which had been operated upon. Out of this number, 471 of the tumors were said to have been 'removed,' but as we now understand it, the removal in many instances, even of the benign growths, was doubtless far from complete. In the remaining 357 cases the tumor was not removed, and there were 263 deaths in the series, a mortality of 32 per cent. . . ."

"After the year 1906, when Knapp had collected his dreary operative statistics on brain tumors, a great deal of progress was made during the next decade. In 1913 Tooth\(^4\)\(^5\) analyzed a series of 500 probable tumors from the National Hospital, Queen Square, and of these, 265 had been operated upon between 1902 and 1911, in the majority of instances unquestionably by Sir Victor Horsley. Out of the 265, there were 187 verified tumors and from this number there were at least 83 operative deaths, a mortality of 44 per cent. Nevertheless, there were 31 patients living at the time of Tooth's paper, a much better record than the figures Knapp had indicated in 1906, . . ."\(^3\)

"Keen\(^4\) in 1892 advised that cerebral tumors be enucleated, if possible, with the finger, but if this were impossible, then a knife, scissors, sharp spoon or ordinary teaspoon be used to remove the entire mass piecemeal. If the tumor were subcortical, then a tiny incision was made into the cortex and the tumor could be palpated and removed with the little finger.

"This rapid removal of tumors was common practice until the advent of Cushing with his slow careful technique. In his 1908 monograph\(^1\) he stated, 'An encapsulated tumor may be shelled out of its bed, with but little bleeding, by careful manipulations and the proper use of cotton which I prefer to hot irrigations as a hemostatic. When the cortex is to be incised above a tumor which has not reached the surface, the individual cortical vessels radiating from it must be doubly ligated with delicate strands of split silk, and the cortex incised between ligatures. Below the cortex there is often surprisingly little bleeding. The brain must be carefully separated from the growth with smooth, fairly blunt dissectors, and if bleeding occurs, a pledget of cotton is placed in the gap while another side is worked upon. In this way, by slow dissection, the tumor can often be clearly outlined with but little loss of blood and the production of no shock. The attempt to hurriedly dislocate a tumor outward by plunging fingers into the brain is atrocious. There should be a legal penalty imposed for 'speeding' in brain surgery.' ([2], p. 240.)\(^3\)

"Tooth's figures of Horsley's tumor patients were . . . eclipsed . . . by the statistics offered by
Cushing \( ^{[9] } \) in 1915. In this report, which was an elaboration of his discussion of a paper by Professor Kittner on the operative treatment of brain tumors, Cushing reviewed the current operative mortality statistics pertaining to brain tumors as published at that time by the leading surgeons doing this type of work. Kittner’s own mortality was 43 per cent; that of Krause about 50 per cent; and of Eiselsberg 88 per cent. We have seen that Horsley’s mortality was in this general neighborhood. Cushing astounded his listeners by submitting a mortality figure of 6.6 per cent for supratentorial tumors, and of 17 per cent for those below the tentorium or a combined mortality of 8.4 per cent for all patients operated upon. A further feature of extreme importance in Cushing’s report was the fact that he had lost but one patient from meningitis, whereas in the Vienna series 10.5 per cent, and in the London series 11.7 per cent, of the patients had succumbed from this type of infection. As Cushing pointed out, the reason for this absence of sepsis in his cases was due to his careful closure of the galea as well as of the skin, thus preventing the wounds from breaking down, with the resultant fungus and meningitis.\(^{[23]}\)

During the ensuing years Dr. Cushing and his associates encountered a large number of intracranial tumors, which they classified, studied, and treated.\(^{[1,2,9—27,31,41,49,54]}\) Our present knowledge of brain tumors is largely based on these experiences.

In 1931 Dr. Cushing performed an operation which

“...served to verify the 200th brain tumor in his series. Without his knowledge the staff had made elaborate preparations for photographs, movies, and a gala tea party reminiscent of that held on his sixtieth birthday....

“Louise Eisenhardt, fully prepared for the occasion, had all the tumor statistics available and was able to point to a steady lowering of Cushing’s mortality rate during the previous ten years, save for a brief increase... immediately after the introduction of electro surgical methods. Since there was no other comparable tumor series with which to compete, Cushing had become consumed with a desire to improve his own figures from year to year. He accordingly began in earnest to prepare on these lines for the ‘paper’ to be read at the International Neurological Congress in Berne—a paper which grew into a monograph and was later published by his friend, Charles Thomas\(^{[50—52]}\)....”\(^{[29]}\)

At a meeting of the American Neurological Association on May 24, 1931, Dr. Cushing gave a preliminary account of

“...the mortality statistics pertaining to his large series of verified brain tumors, a grand total of 2,023 patients, 1,870 of whom were operated upon.\(^{[13,20]}\) There were 382 postoperative deaths, namely, patients who died in the hospital from any cause whatever after operation, giving a case mortality of 20.4 per cent. This series, of course, included all of Dr. Cushing’s brain tumor patients, starting with his earliest experiences in Baltimore in 1902. When the extremely high mortality of the early years is considered, it is indeed amazing that his total mortality was as low as it proved to be. As a contrast to the figures for the whole series, Cushing included the statistics for the three years previous to the communication. These showed that 412 patients with verified intracranial growths had been operated upon during that time, with 55 postoperative deaths, a case mortality of 13.3 per cent....”\(^{[32]}\)

A few months later Dr. Cushing presented a revised version of the same material at the First International Neurological Congress in Berne,\(^{[17—19]}\) Twenty-five of his pupils attended, most of them to hear Dr. Cushing present his paper.

“Much of the life of the Congress centered about Dr. Cushing. He was returning after thirty years to the town where he grew up, as it were, and where he received the greatest inspiration for his life’s work—and he was returning now to give an account of himself in the interval....

“The Congress opened on Monday, 31 August, in the Municipal Casino. The high point of this session was the awarding (by the University of Berne) of honorary degrees to Cushing and Sir Charles Sherrington. That the degrees were to be given had been kept in the utmost secrecy and was to be a surprise to both of the recipients. Considerable difficulty was encountered in persuading Cushing that his presence at the session was imperative, for as usual he was belatedly putting the finishing touches on his paper for the afternoon session....

“In the introduction to his paper, fourth on the program of the afternoon session, Cushing described his experiences in Berne in 1900—1901. At the beginning he spoke somewhat haltingly, but within a few minutes the hall was silent as he described the various factors which had led to the dramatic fall in his mortality rate in cerebral operations. ‘Younger men,’ he went on to say, ‘picking up where I leave off, can reduce the mortality still further.’ Then came the devastating and unexpected climax: ‘Gentlemen, this will be the last report on the statistical results of brain tumors as a whole that I shall ever publish.’ After