A national survey of the management of patients with incidental meningioma in the United Kingdom

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Abstract

Background: Incidental meningiomas are increasingly being diagnosed due to widespread use of brain imaging. Treatment options include surveillance, surgery and stereotactic radiosurgery, but the natural history of these tumours is not fully understood and there are no accepted management guidelines to aid clinical decision-making. The aim of this study was to assess current practice in the United Kingdom and identify areas of variation for further study. **Methods:** A questionnaire was distributed to all members of the Society of British Neurosurgeons (SBNS). The main components of the survey included the assessment of which factors and tumour characteristics are considered in the management and follow-up of incidental meningiomas. Two case scenarios were also presented. **Results:** The response rate was 12.5% (44 completed surveys) with 74% (25/34) of neurosurgical centres represented. Absence of calcification was only considered by 36% (16/44) of neurosurgeons. Most neurosurgeons opt for surveillance at initial presentation, and the length of follow-up was 5 years (14/33) and 10 years (11/33). The case scenarios highlighted that tumour growth at follow-up resulted in a preference to change from surveillance to treatment with surgery or SRS. SRS was preferred in skull-base (23/36) and medial sphenoid wing (16/39) tumours. **Conclusions:** This survey has demonstrated that certain aspects of incidental meningioma management show variation and remain controversial. Further research through prospective cohort studies is required to provide evidence to support guidelines for the management of incidental meningiomas.

Key words

Meningioma, MRI, management, incidental

Introduction

Meningiomas are the commonest primary brain tumour and the incidence varies from 1 - 8.4 per 100,000 and rises progressively with each decade of life [1]. Symptomatic meningiomas cause headache, epilepsy or focal neurological deficit and have clearly defined management algorithms that involve surgery as the first line treatment. Meningiomas may also be diagnosed as incidental findings on computed tomography (CT) or magnetic resonance imaging (MRI) performed for other reasons, such as minor head injury. The widespread availability of MRI has led to increased reporting of incidental findings, and patients are becoming so-called Victims Of Modern Imaging Technology (VOMIT) [2]. The finding of an incidental meningioma leads to patient anxiety and uncertainty about the future [3]. The majority of Incidental meningiomas are small but they all have growth potential and may become symptomatic [4]. Whilst these can be treated with surgery or stereotactic radiosurgery (SRS), this may be an unnecessary risk for the patient if the meningioma does not grow and remains asymptomatic. The aim of this study was to survey the current clinical practice of UK neurosurgeons with regards to the management of incidental meningiomas.

Materials and Methods

Clinical practice questionnaires were emailed to all members of the Society of British Neurological Surgeons (SBNS). The questionnaire was approved by the SBNS academic committee. There are approximately 349 consultant neurosurgeons in the UK and those with a predominantly adult and cranial clinical practice were invited to respond. The survey was open between 13th April 2015 and 19th June 2015 - a second email reminder was issued after one month and a £50 gift voucher prize draw was used as an incentive.

The survey was designed to collect data on: (i) departmental protocols, (ii) patient factors including age and co-morbidities, (iii) MRI factors such as tumour location, T2 signal change and calcification, (iv) MRI follow-up schedules, and (v) management of two case scenarios (Figure 1A-B & Table 1)

Results

A total of 44 responses were received from 349 consultant neurosurgeons contacted across the UK (12.6% response rate). There was a good geographical distribution covering 25 neurosurgical units. The number of incidental meningiomas reported in UK neurosurgical centres ranged from 15- 150 a year. Only two units reported having a departmental protocol for the management of these tumours.

Decision making factors considered at initial clinical encounter

The question regarding this subject was completed by all 44 neurosurgeons. Patient preference was considered by 96% (42/44) of responders. Patient age was taken into account by 89% (39/44). Co-morbidities influenced clinical judgement in 89% (39/44) of responders. Tumour location and tumour size were considered by 96% (42/44) and 93% (41/44) respectively. Absence of calcification was regarded as an important factor by 36% (16/44) and peri-tumoural T2 signal change by 77% (34/44) (illustrated in Figure 2A). Other factors highlighted by some neurosurgeons as free text responses included patient occupation, importance of driving, radiological uncertainty, presence of mass effect and past medical history of malignancy.

Follow-up MRI schedules

Responses concerning MRI timing were completed by all 44 neurosurgeons. The majority neurosurgeons opt for an initial first follow-up MRI at 6 months (34/44; 77%), and then move patients onto a subsequent 12 monthly MRI (40/44; 91%) as shown in Figure 2B. In free text responses some neurosurgeons commented that the initial follow up MRI timing also depends on meningioma size and previous cancer history. Only 33 neurosurgeons completed the section on long-term follow up. Discharge from regular clinical follow-up was considered by 95% (42/44). Patients who had a stable MRI scan were discharged at 5 years by 42% (14/33) and at 10 years by 33% (11/33). Follow-up for over 10 years was preferred by 24% (8/33). Other reasons offered as free text responses for discharge from follow up included advanced age with heavily calcified tumour, slow growing tumour or significant co-morbidities (Figure 2B).

Case Scenarios

For both case scenarios at initial presentation, the majority of neurosurgeons opted for a conservative approach. Observation with MRI surveillance at first presentation was preferred by 89% (39/44) for case 1 and 96% (42/44) for case 2. At follow-up for case 1, most opted for surgical resection (21/44; 48%) and only 11% (5/44) chose continued observation. For case 2, fewer opted for surgical resection (12/44; 27%) as shown in Figure 1C.

Treatment preference according to tumour location and size

Questions on treatment preference according to tumour size and location were not consistently completed by all neurosurgeons. For superficial meningiomas surgery was

the treatment of preference for convexity (33/40; 83%), parasagittal (27/39; 69%), parafalcine (26/40; 65%) and lateral sphenoid wing (30/40; 75%) locations. Stereotactic radiosurgery was preferred for the treatment of medial sphenoid wing (16/39; 41%) and skull base tumours (23/36; 64%) as shown in Figure 3. At initial clinical presentation of an incidental meningioma, 80% (24/30) of neurosurgeons reported that they would perform surgery or SRS if the tumour was ≥2.5 cm in diameter. A meningioma with a diameter of ≤1.5 cm would receive surgery or SRS from only 16% (3/19). At follow-up, for a tumour with a diameter of 1.5 – 2.5cm, surgery or SRS was considered appropriate management by 76% (19/25) and 24% (5/21) tumour respectively.

Discussion

This national neurosurgical survey has highlighted wide variation in the current clinical management of incidental meningioma in the UK. Several trends were observed, namely that most surgeons provide 5-10 year follow-up, favour surgical treatment over radiosurgery and that at the initial presentation of incidental meningioma a period of MRI surveillance is usually instituted.

Factors considered in patient management

One objective of the survey was to identify those factors that are taken into account by neurosurgeons when developing a management plan. The published literature on the natural history of incidental meningioma comprises mainly retrospective studies. A meta-analysis of 22 retrospective studies (n=675) revealed that the risk for developing

symptoms is higher for a meningioma between 2-2.5cm in initial diameter, but ~50% of cases remain static, and the other 50% grow at an annual linear growth rate of 3-75% [5]. Other studies suggest that meningiomas may reach a stable plateau [6]. Whilst most neurosurgeons considered patient factors and tumour location, MRI features were considered less frequently; 65% of neurosurgeons did not consider absence of calcification as an influential factor, and peritumoral T2 signal intensity was not taken into account by 23%. This is in contrast with the combined published literature of over 550 patients that shows that absence of calcification and peritumoral T2 signal change are the main MRI features associated with more rapid meningioma growth [7] [8] [9] [10] [11] [12] [13].

Follow-up strategies

Many of these tumours are likely to be discussed at the neuro-oncology or skull base multi-disciplinary team (MDT) meetings. The follow-up of brain tumours, including meningiomas, consists of interval MRI to monitor tumour growth. Although the role of the MDT in managing incidental meningioma was not specifically asked in the survey, recommendations from the MDT will consider patient age, tumour location and MRI characteristics. This survey highlighted that early follow-up MRI was relatively consistent between neurosurgeons as approximately 80% chose the first follow-up MRI scan to be at 6 months and 90% selected subsequent MRI scans to be 12 monthly. Some neurosurgeons highlighted that the frequency of follow-up was also dependent on the patient age and size of meningiomas, such that older patients with small meningiomas could undergo less frequent MRI scans. Seven neurosurgeons responded that an initial 3-month MRI was performed, principally to address the possibility of metastatic cancer. For a meningioma with a typical MRI appearance, however, this is probably unnecessary, since studies have shown that the initial growth period of incidental

meningiomas is low [14]. Indeed, less frequent use of MRI at an early stage may also reduce patient anxiety as well as being more cost-effective for the health service. The overall follow-up period showed the most discrepancy between the responders. Stable MRI scans for 5 years led to discharge by 42% of neurosurgeons and a 10-year follow-up was preferred by 33%. A recent study demonstrated that 75% of incidental meningiomas will show growth at 15 years [4]. In this survey, three-quarters of neurosurgeons discharge stable patients after 10 years, which may miss late meningioma growth. This is particularly important since incidental meningiomas do not always follow a linear growth pattern and unexpected, exponential growth can occur [12]. These findings should be taken into account especially for younger patients who have a longer life expectancy.

Case Scenarios

The two case scenarios in the survey were selected to create a standard model that would allow the measurement of variation in treatments offered to the same patient by different neurosurgeons. Whilst most neurosurgeons elected to monitor both cases at presentation, approximately 10% of responders opted for surgical resection in the younger patient, even though the tumour was located over the motor strip and the patient was a practising dentist. The major discrepancy occurred in the follow-up management for both cases, who remained asymptomatic and showed a relatively small growth of the tumour over 4 years. For the older patient, approximately 25% chose observation and another 25% preferred surgery, whereas for the younger patient 48% of surgeons now elected to operate. SRS was chosen for both cases by 14% of neurosurgeons. The variation in responses is likely to reflect different clinical experiences, and even for small meningiomas any treatment offered carries some risk of

morbidity and mortality. Indeed both surgery and SRS are associated with higher mortality in older patients and multiple studies have concluded that conservative management is more suitable in this age group [15-18]. Similarly, in older patients surgery should be reserved for large symptomatic meningiomas.

Tumour location and size

SRS was the preferred treatment modality for medial sphenoid wing and skull-base tumours, which reflects the minimally invasive nature of radiosurgery compared to open surgery. However, the benefits of SRS for small asymptomatic meningioma are debated, since it is used for smaller tumours that may have low growth potential, and published studies often have short follow-up [19]. Although the natural history of incidental meningioma is that 50-75% will grow over time, a meningioma <2cm may not cause symptoms [5] and treatment by SRS would expose the patient to unnecessary radiation and potential risk of necrosis. A study of gamma knife radiosurgery for small asymptomatic meningiomas showed good control rates but a 4.8% adverse event rate, that included transient hemiparesis [20]. For patients with a benign, incidental tumour the benefits of treatment should always outweigh the risks, and overtreatment should be avoided.

Conclusions

Although the response rate of this survey study was only 12.5%, this is similar to other published neurosurgical survey [21]. Since responses were received from 74% of neurosurgical centres, the findings of this study can be reasonably extrapolated in assessing current UK management of incidental meningiomas. The variation in follow-up and the case scenario management highlights the need to consider the development

of guidelines that can facilitate clinical decision-making. Treatment of incidental meningiomas should be defined on an individual basis as multiple factors are considered, however general recommendations can still be beneficial. Ultimately for the patient, the question they want answering is "will my incidental meningioma become symptomatic and will I need treatment within my lifetime?" To provide a personalised estimate of the need for treatment would require modelling of growth patterns in relation to patients, clinical and radiological variables. A large, multi-centre study would be need to collect data to develop a 'risk calculator' similar to that used for unruptured aneurysms. The health economic implications of repeated MRI and clinical follow-up for patients with asymptomatic incidental meningiomas remains unknown and prospective studies are required to develop algorithms that minimise unnecessary treatment and optimise quality of life.

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Declaration of Interests

The authors report no declaration of interests.

Author contributions

MDJ conceived the study and designed the questionnaire. MM collected and analysed the data. EC, RZ and AB contributed to data interpretation. All authors approved the final manuscript. MDJ is guarantor for the study.

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Figures and tables

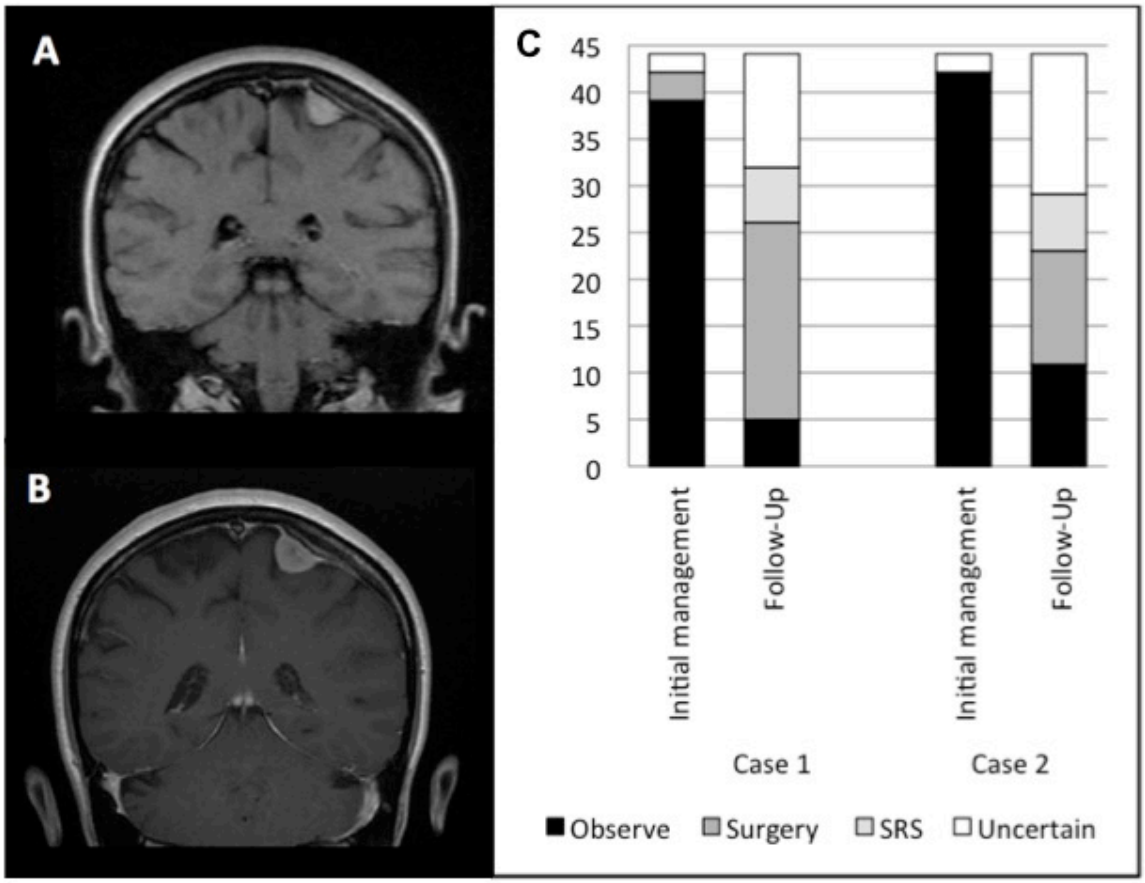

Figure 1

Coronal contrast enhanced MRI shows a left posterior frontal convexity meningioma over the motor cortex at (A) presentation with a 2cm diameter and (B) four years later with a 2.5cm diameter. The clinical features were of an incidental finding after MRI for dizziness that remained asymptomatic at follow-up. The management options of observation, surgery or SRS were offered at presentation and follow-up. (C) In scenario 1, the patient was a 35 year old dentist and at initial presentation neurosurgeons selected observation (39/44), surgery (3/44) or were uncertain (2/44), whilst at follow-up there was a preference for surgery (21/44), compared to continued

observation (5/44), SRS (6/44) or uncertainty (12/44). In scenario 2 the patient was a 70 year old retiree and at initial presentation observation (42/44) was chosen while some were uncertain (2/44). At follow-up, observation (11/44), surgery (12/44), SRS (6/44) were selected while a large number of responders were uncertain (15/44)..

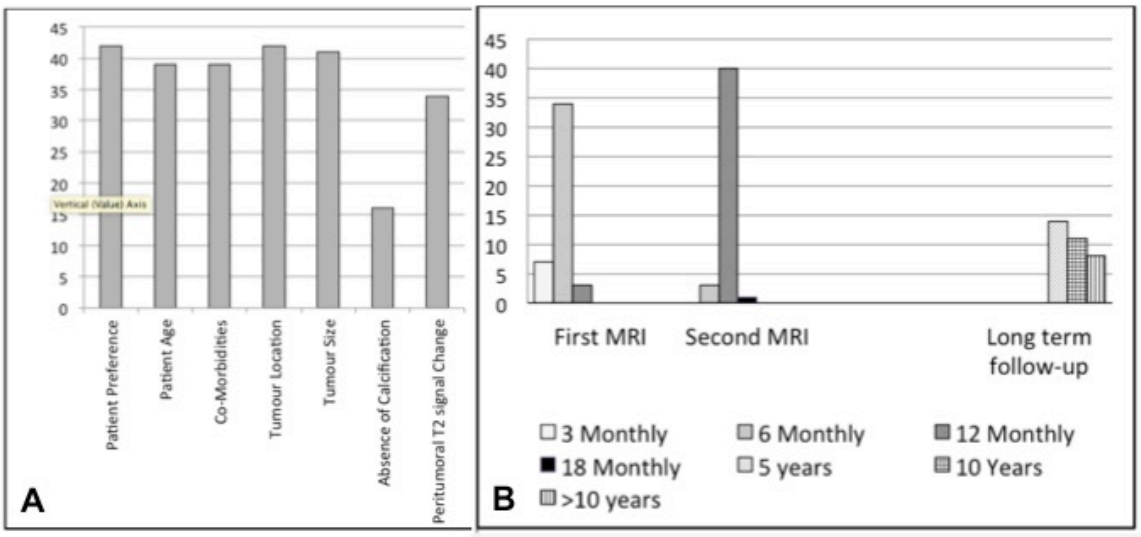

Figure 2

Response of 44 neurosurgeons to the question (A) "at the initial clinical encounter what clinical factors would influence follow-up of an incidental meningioma?" Absence of calcification was the least considered tumour characteristic (36%), while patient preference (96%) and tumour location (96%) were the most considered. Responses to the question (B) "what frequency of MRI follow-up would you undertake at initial and subsequent clinical encounters for an incidental meningioma?" At first follow-up MRI was considered at 3 months (7/44), 6 months (34/44) and 12 months (3/44). Second follow-up MRI was performed 6 monthly (3/44), 12 monthly (40/44) and 18 monthly (1/44). Overall follow-up was 5 years (14/33), 10 years (11/33) and >10 years (8/33).

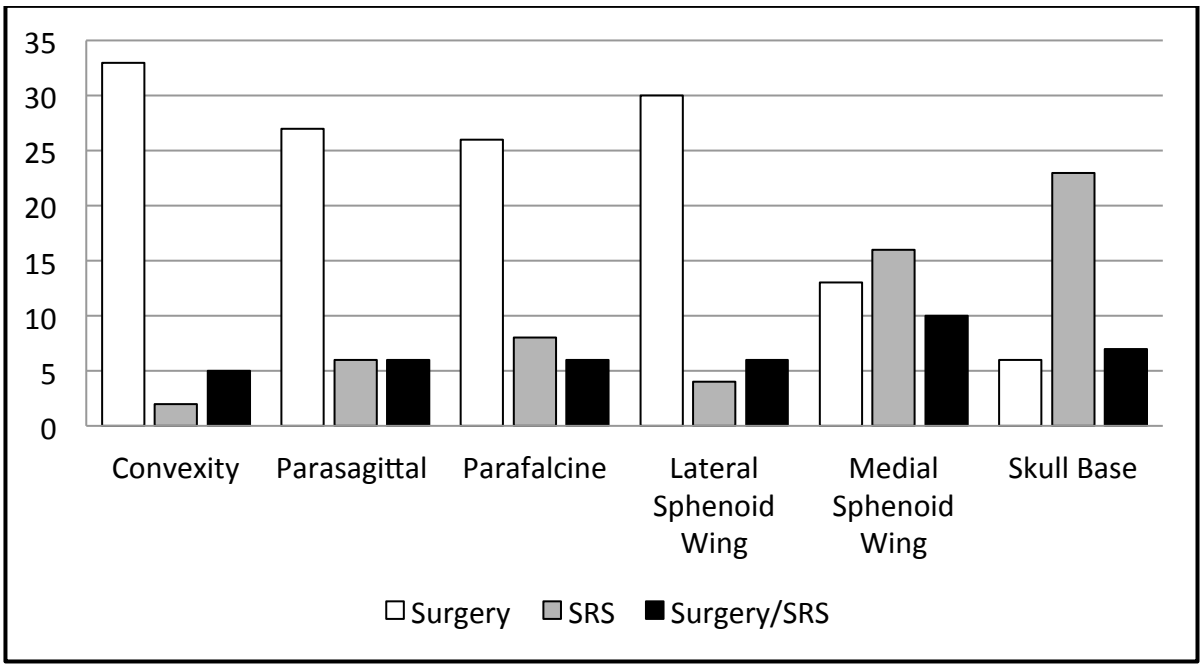

Figure 3

Treatment modality preference according to anatomical location.

Table 1

Components of the survey used to assess clinical management.

Clinical and MRI factors	**MRI follow-up schedule**
• Patient preference	• First follow-up MRI
• Patient age	• Second follow-up MRI
• Co-morbidities	• Length of follow-up
• Tumour location	• Likelihood of discharge
• Tumour size	
• Calcification	
• Peritumoural T2 signal change	