出國報告(出國類別：短期進修)

立體放射治療多方面應用於中樞神經系統疾患治療

服務機關：國防醫學院三軍總醫院
姓名職稱：周冠年 主治醫師
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摘要

引言

在過去的一年裡，我有幸能夠前往美國加州史丹佛神經外科部神經腫瘤科進修，這次經歷對我來說是一個深刻的學習和成長機會。我前往美國加州史丹佛醫院，參加了立體定位放射治療多方面應用於中樞神經系統，這個經驗對我的專業和個人生活都產生了深遠的影響。

學術收穫

在美國加州的史丹佛醫院神經外科部以臨床觀察員及研究學者的名義參與神經系統立體放射治療臨床經驗及研究學習，我獲得了豐富的學術知識。這個課程不僅提供了新的學科內容，還讓我體驗到不同教學風格和學術環境。我在這個課程中學到了很多關於立體放射治療的新觀點和理念，也完成四個研究論文，這將對我的未來神經外科醫療生涯產生積極的影響。

跨文化體驗

在國外進修期間，我有機會與來自不同國家的同學互動，這擴展了我的國際視野。我學習到了如何有效地與不同文化背景的人合作，並且更加了解了美國的文化和生活方式。這種跨文化體驗對於我個人的成長和將來的國際交往都非常重要。

語言能力提升

在美國加州，我不得不使用英文來生活和學習。這對於我的語言能力提升來說是一個極大的挑戰，但也是一個寶貴的機會。我現在更加流利地使用英文，這對於未來的職業發展和國際交流都將大有幫助。

結論

在出國進修的這一年裡，我經歷了許多難忘的時刻，學到了很多寶貴的教訓。這次經歷不僅對我的學術和專業生涯有所助益，還豐富了我的生活經驗，讓我變得更加全面。我將永遠珍惜這次出國進修的機會，並期待著將所學應用到未來的生活和工作中。

目的

因應三軍總醫院將採購新型立體放射治療設備及發展立體放射治療，在神經外科應用於中樞神經疾患部分，由我代表前往國際應用立體放射治療的翹首史丹佛醫院神經外科學習臨床使用經驗。

過程

在台灣通過各種申請國外短期進修資格包含智力測驗、托福英文及體能測驗等，在三軍總醫院神經外科部朱大同主任的引薦下，成功申請前往美國加州史丹佛醫院神經外科部學習。在參與的團隊成員為指導老師義大利籍 Antonio Meola，其他學員包含土耳其籍 Ulas、印度裔 Nealan 及韓裔 David Park 等多國文化背景。第一次應用英文在如此環境與大家交流，大家來到同一醫院部門學習的因緣也各有不同，有嚮往美國生活、來學習立體放射治療專長、藉短期訓練學習不同的醫療文化等背景。每週有定期討論會及各種不定期小組討論會參與，每天在治療室中也學習各種疾病的治療其中也包含許多前衛的各式人體研究等。在這種氛圍及工作環境下，研究資料申請及資訊安全都是很便捷讓大家可快速申請及調閱病歷，大家也可以在臨床工作之餘有效性地完成各自的研究，我也在同儕的影響下完成四份脊椎轉移性腫瘤的相關治療研究，[1]Vertebral Fractures Following Primary Stereotactic Body Radiotherapy for Spinal Bone Metastases: A Decade of Experience; [2]Stereotactic Body Radiotherapy in Treating Painful Spinal Metastases: A Decade's Experience at a Single Institution; [3]Prognostic Value of Revised Tokuhashi and Spinal Instability Neoplastic Scores in Primary Stereotactic Body Radiotherapy for Spinal Bone Metastases; [4]Primary Stereotactic Body Radiotherapy for Spinal Bone Metastases from Non-small Cell Lung Cancer。另外也協助完成兩項應用立體定位放射治療 paraganglioma over the carotid artery and donut-shaped contouring in severe spinal bone metastases 等兩研究。雖是研究過程非常便捷但在研究撰寫及審核過程為非常嚴謹以確保代表研究的水準。另外，老師們也很歡迎學員們參與各式研究，學員完成研究後也不會有學術倫理的爭議發生，我覺得美國醫療遠比台灣進步，在這些環節下也都是台灣學術及醫療環境需學習改進。

心得及建議

在過去的一年裡，我有幸能夠前往美國加州史丹佛神經外科部神經腫瘤科進修，這次經歷對我來說是一個深刻的學習和成長機會。在三軍總醫院的臨床研究申請及展延步驟非常繁瑣，但在史丹佛醫院各種病例記錄已達到完整電子化且不如國內病例記錄刻板要求，在調閱病歷資料過程中非常便捷及迅速，在如此便利的環境下，學術研究自然就蓬勃發展，這些讓史丹佛醫院及學校在國際的學術地位仍位居翹首，這些優點都值得台灣或三軍總醫院醫療學術研究者學習。

研究摘要一

Objective: The aim of this retrospective study is to comprehensively evaluate the factors that contribute to and protect against the occurrence of vertebral fractures (VFs) following stereotactic body radiotherapy (SBRT) for the treatment of spinal bone metastases (SBM).

Methods: This study focused on adult patients who underwent primary SBRT for the management of solid tumor SBM between March 2012 and January 2023. Target volume delineation for sacral and spinal SBRT was conducted in accordance with the International Spine Radiosurgery Consortium guidelines. We specifically included patients with detailed follow-up medical records for at least six months after completing SBRT. SBM showing local progression during the follow-up period were excluded. To assess the relationships between various factors and the occurrence of VFs post-SBRT, the Spinal Instability Neoplastic Score (SINS) was primarily used in our assessment.

Results: A total of 322 patients, covering 487 lesions and 592 vertebrae, were examined. The occurrence rate of VFs, including post-SBRT VFs on treated vertebrae and adjacent VFs (AVFs), stood at 16.0%. Specifically, post-SBRT VFs accounted for 15.2%, while AVFs made up 3.1%. Several factors were found to significantly contribute to VFs, such as older age, higher SINS indicating spinal instability, osteolytic destruction, pre-existing SBRT VFs, and increased target lesion size. Post-SBRT VFs were predominantly of a biconcave shape, and were majorly classified as moderate to severe, especially below T10 levels. Patients administered antiresorptive agents (ARAs), namely bisphosphonates and denosumab, had a lower incidence of VFs compared to those treated with only SBRT.

Conclusion: Greater spinal instability in SBM correlated with a higher likelihood of VFs, especially in lesions with osteolytic destruction or pre-existing SBRT VFs. Using ARAs was associated with a reduced occurrence of VFs. This protective effect was most pronounced during denosumab treatment, particularly when denosumab was administered consistently before SBRT.

研究摘要二

Objective:

This study aimed to retrospectively evaluate the efficacy of stereotactic body radiotherapy (SBRT) for pain relief in patients with painful spinal bone metastases (SBM) and to identify key factors contributing to treatment outcomes.

Methods:

We conducted a retrospective analysis of adult patients who underwent SBRT for painful solid tumor SBM between March 2012 and January 2023. During this period, treatment conformed to the International Spine Radiosurgery Consortium (ISRC) guidelines for target volume delineation in both sacral and spinal SBRT. To be included, patients needed to have persistent moderate to severe pain (visual analog scale (VAS) score ≥4) directly associated with SBM, warranting regular opioid treatment. Positive pain relief post-SBRT was defined by three criteria: a decrease in VAS scores, a reduction in opioid dosage, and a concurrent improvement in daily activities.

Results:

The study encompassed 377 patients, covering 576 lesions across 759 vertebrae. Of these, 332 lesions showed significant pain relief within three months following SBRT. Lower pain relief rates correlated with diabetes mellitus and a revised Tokuhashi score of 0 – 8. In contrast, higher relief rates were linked to treating a single painful SBM in one SBRT session, greater involvement of ISRC sites, and higher prescription doses. Pain relief rates for prostate cancer and hepatocellular carcinoma stood at 73.8% and 26.4%, respectively. The presence of pre-SBRT vertebral fractures and the use of concurrent systemic cancer therapies or antiresorptive agents, including bisphosphonates and denosumab, did not notably influence the pain relief efficacy of SBRT.

Conclusion:

With a pain relief rate of 57.6%, SBRT emerges as an effective treatment option for managing painful SBM. Our results highlight the importance of various factors in enhancing pain relief through SBRT, offering a nuanced understanding of its effectiveness in addressing painful SBM.

研究摘要三

Objective: We applied the revised Tokuhashi scoring (rTS) and spinal instability neoplastic score (SINS) to assess treatment outcomes and adverse events (AEs) associated with primary stereotactic body radiotherapy (SBRT) for spinal bone metastases (SBM).

Methods: In this retrospective study, adult patients who underwent CyberKnife for primary SBRT treatment of solid tumor SBM at Stanford University Medical Center, California, USA, between March 2012 and January 2023, were included. Patients were categorized into Group 1 (those with medical records for at least six months post-SBRT) and Group 2 (those with records for less than six months). We analyzed SBM characteristics using the rTS and SINS to ascertain their influence on local control (LC) efficacy and post-SBRT adverse event frequency.

Results: Group 1, consisting of 393 patients with a total of 632 SBM lesions affecting 771 vertebrae, demonstrated an LC rate of 76.9%. The average time to local progression (LP) was 18.7 months, predominantly seen in cases with more severe generalized bony metastases. Factors like a stable spine pre-SBRT, lack of epidural extension in SBM, single SBRT course for multiple (≥2) lesions, and simultaneous systemic cancer treatments correlated with elevated LC rates. The rate of vertebral collapse was 18.2% over an average period of 13.8 months. Furthermore, an acute AE rate of 36.1% was identified from 907 lesions across both groups. The main acute AEs post-SBRT were acute pain flare (16.0%), fatigue (8.4%), and radiation neuropathy (6.0%).

Conclusions: Relative to the rTS, SINS proves to be a superior predictive tool for treatment efficacy. The results emphasize the crucial influence of diverse factors on enhancing LC through SBRT. This analysis deepens our understanding of SBRT's efficacy and potential challenges, guiding the incorporation of varied treatment modalities for optimal SBM management.

研究摘要四

Objective:
This study aimed to assess the results of primary stereotactic body radiotherapy (SBRT) for spinal bone metastases (SBM) originating from non-small cell lung cancer (NSCLC). We considered the revised Tokuhashi score, Spinal Instability Neoplastic Score (SINS), and genetic characteristics.
Methods:
We enrolled adult NSCLC patients who underwent primary SBRT (using the CyberKnife System) for SBM following the International Spine Radiosurgery Consortium guidelines for target volume definition between March 2012 and January 2023. All participants had detailed medical records spanning at least 6 months post-SBRT.
Results:
We analyzed data from 110 patients, covering 164 SBM across 214 vertebrae. The local control (LC) rate post-primary SBRT for NSCLC-derived SBM was 76.8%. The mean follow-up periods for SBM with LC and those exhibiting local progression (LP) were 22.3 and 14.0 months, respectively. Stable spinal structures and osteoblastic bone damage were notably linked with elevated LC rates according to the SINS, suggesting its potential as a predictive tool. Patients achieving LC for SBM had improved survival compared to those with LP. A higher body mass index was observed to influence LP onset, while denosumab treatment seemed to enhance LC. Among the 97 SBM from adenocarcinoma, positive programmed death-ligand 1 (PD-L1) results were noted in 97 cases. Additionally, 62 of these had epidermal growth factor receptor (EGFR) mutations alongside PD-L1 expression. A trend toward reduced LC rates was seen in SBM with either low PD-L1 expression alone or those with EGFR mutations combined with low PD-L1 expression compared to those negative for PD-L1 or with high PD-L1 expression.

Conclusion:
The LC rates were 76.8% for NSCLC-related SBM and 77.6% for those from the adenocarcinoma subtype using CyberKnife as the primary SBRT method. Overall, the study emphasizes the influence of diverse factors on LC after primary SBRT, highlighting the need to incorporate varied treatment approaches to optimize care for SBM in NSCLC patients.