Original Investigation

Correlation between suspected diagnosis by Magnetic Resonance, and definitive diagnosis by Stereotactic-Guided biopsy in Mexico City between 2017 and 2021

Correlación entre sospecha diagnóstica por Resonancia Magnética, y diagnóstico definitivo por biopsia Estereotáctica-Guiada en la Ciudad de México entre 2017 y 2021

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ABSTRACT

Objective: Stereotactic brain biopsy, which employs imaging techniques such as computed tomography, is an important tool not only for obtaining an accurate diagnosis but also for avoiding damage to vital structures.

Methods: We collected data through our computer-based system Comprehensive Hospital Administration System (CHAS) and the images through Synapse, an internet-based software in our medical center. Only one neurosurgeon performed all biopsy procedures, and all biopsy materials were evaluated by two pathologists.

Results: Our diagnostic performance was average for a total of 83.87 % compared to the greatest series resulting > 90 %, and 39 of them matched the magnetic

resonance image with the histopathological diagnosis for a total of 62 %, which is considered low.

Conclusion: Magnetic resonance imaging (MRI) and histopathologic diagnosis had a 74 % correlation, which is considered average. Histopathological diagnosis is entirely dependent on pathology specialists, which is why we need an initial guideline in this case, magnetic resonance.

Keywords: biopsy; brain; lesions; magnetic resonance; neoplasm; stereotactic.

RESUMEN

Objetivo: La biopsia cerebral estereotáctica, que emplea técnicas de imagen como la tomografía computarizada, es una herramienta importante no sólo para obtener un diagnóstico preciso sino también para evitar daños en estructuras vitales.

Métodos: Recogimos los datos a través de nuestro sistema informático *Comprehensive Hospital Administration System* (CHAS) y las imágenes a través de Synapse, un software basado en internet en nuestro centro médico. Sólo un neurocirujano realizó todos los procedimientos de biopsia, y todos los materiales de biopsia fueron evaluados por dos patólogos.

Resultados: Nuestro rendimiento diagnóstico fue medio para un total de 83,87 % frente a las mayores series que resultaron > 90 %, y 39 de ellas hicieron coincidir la imagen de resonancia magnética con el diagnóstico histopatológico para un total de 62 %, lo que se considera bajo.

Conclusiones: La resonancia magnética (RM) y el diagnóstico histopatológico tuvieron una correlación del 74 %, lo que se considera medio. El diagnóstico histopatológico depende totalmente de los especialistas en patología, por lo que en este caso necesitamos una pauta inicial, la resonancia magnética.

Palabras clave: biopsia; cerebro; lesiones; resonancia magnética; neoplasia; estereotáctica.

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Introduction

In this manuscript we observe the correlation between suspected diagnosis by Magnetic Resonance, including some of the sequences, and definitive diagnosis by Stereotactic-Guided biopsy, between 2017-2021 in Mexico City, we compared to greatest series studies. There are many pathologies identified in this study but the most prevalent was high grade astrocytoma with 43% of our sample. Our objective was to identify 70% of accuracy correlation which is considered average. We include some images of the most interesting cases in magnetic resonance and in histopathology. We confirmed the adherence to guidelines.

Methods

We collected the data over an out our computer-based system (SIAH) and the images via TESI also an internet-based software in our medical Centre. All biopsy procedures were performed by only 1 neurosurgeon (Dr. Hernandez – Salazar Manuel,[3] and all the biopsy materials were evaluated by 2 pathologists. Between 2017-2021, we obtained 62 stereotactic biopsies at Centro Medico Nacional 20 de Noviembre, Mexico City, department of functional Neurosurgery.

The stereotactic ring fixation was done under local anesthesia (.4ml dexmedetomidine, 10ml bupivacaine, and 4ml of lidocaine 2 %) doing scalp block technique, associated in children with light sedation with great results after taking the sample, we also encounter less postoperative pain in 62 out of 62 patients. An 8-10mm burr hole was used as the entry point, pial surface was observed, and took the biopsy with the standard sedan type needle.

Participants: In this document we will report the image guided stereotactic brain biopsy´s accuracy, in 62 patients. Our inclusion criteria were: patients who had a possible lesion or tumor, or in some cases infectious disease, or inconclusive diagnosis men or women, , 61.3% were men, and 38.7% women, the average age was between 50-65 years, hand dominance were right for all of them, 39% of them had hypertension, 48% started their symptoms with disorientation, or cognitive deterioration, and 37% had some sort of disability involving the motor system. Exclusion criteria: pregnancy, altered coagulation laboratories, 80 years or above.

Ethics: We confirm the use of ethics in this manuscript, without harm to patients or animals, all data is shown in the table and images.

Results

Of our population that underwent biopsy, which was a total of 62 our diagnostic performance was average for a total of 83.87% compared to the greatest series resulting > 90%, 39 of them matched the magnetic resonance image with the histopathological diagnosis for a total of 62% which is considered low. Of all the diseases, 27 patients were suspected as high-grade gliomas, 20 of them had a positive correlation when doing the intervention, that is 74%, 5 cases were registered as primary central nervous system lymphomas; there was also a positive correlation in diffuse midline gliomas, in 7 out of 8 cases. Within the prognosis, 88%

of the patients lived more than 1 year, 54% had treatment with chemotherapy, and 66% by radiotherapy, 8% stopped attending to our hospital for follow-up.

The sample considered by chronic inflammation or gliosis involved 10 patients, within it 3 corresponded to high grade gliomas by magnetic resonance image, and started radiotherapy as soon as it was permitted, 2 of them died not related to the procedure 6 months after, and we lost communication with the other half, not attending to follow up.

Discussion

Stereotactic brain Biopsy has greatly improved the neurosurgeon's ability to obtain tissue from lesions located in areas which can be difficult to access via conventional approaches, as Coffrey implied optimal treatment of intracranial mass lesions is possible only after obtaining an accurate histological diagnosis. (Robert J. Coffrey, 1985) As we know the estimate of coordinates is accurate, in some cases with only 1mm margin of error between the predetermined target point and the actual biopsy site. On behalf of patients which had any type of glioma the correlation between the images and the histological diagnosis ascended to 71%; we have some variables to adjust, for instance by all means the pathological results are view dependent, which means that the experience may led to better correlation, instead in some cases the magnetic resonance were incomplete, not all the patients had spectroscopy by the time of the study, and not all of them had ADC to predict malignancy.

Adding some information about the magnetic resonance imaging in glioblastoma[1], they stated that the basic MRI modalities available including T1, T2, T2-FLAIR provided critical clinical information about various processes in the tumor environment. But again, differentiating between a glioma and nonglioma disease just by imaging is still not possible, as specified decades ago, there are several differential diagnoses for ring enhanced lesions, high grade gliomas being one of

them, in fact we experienced a necrosis histopathological diagnosis that led us to think for a high-grade glioma just by taking the importance of the magnetic resonance, and as stated before, these tumors represent increased complexity in neuroimaging diagnostics.[2]

As an interesting point of view, in one study represented as a total sample of 23 patients with brain lesions on MRI, they underwent *O*-(2-[18F]fluoroethyl)-l-tyrosine F-FET PET examination and subsequently PET-guided stereotactic biopsy, conventional MRI, stereotactic frame computed tomography (CT) images and 18F-FET PET images were semiautomatically fused and automatic hot-spot detection within the tumor was performed, as their conclusions a significant negative relationship between low-to-moderate cell density and 18F-FET UR was observed. On the other hand, a significant and positive relationship between 18F-FET UR and patterns of pathological proliferation, as well as expression of GFAP and Olig-2, was observed, concluding that 18F-FET allow to differentiate between high grade gliomas and low-grade gliomas.[2]

Concluding this imaging topic, the application of MRI and other imaging modalities has facilitated the diagnostic of some lesions, current imaging techniques allow for more accurate measurement of contrast enhancing lesions and given the short survival time of patients with high grade astrocytoma, treatment is crucial.[3] In some clinical trials in the last decade, they evaluated bevacizumab in recurrent glioblastoma, the radiographic appearance of malignant gliomas changes dramatically after treatment with the anti-angiogenic monoclonal antibody, finally etiologic diagnosis based on MRI has high sensitivity, but limited specificity of approximately 68%.

For the anesthetic issue we used a pharmaceutical mix including 0.4ml dexmedetomidine, 10ml bupivacaine, and 4ml of lidocaine 2%, and for children we used a maximum of 10ml to perform the scalp block, and for adults 15ml, contrasted with the population from Dr Eric Talamoni[4] which only used lidocaine 2%, we have great results involving less postoperative pain, and in some cases

which require awake protocol, we use it with outstanding results, in almost of all the population they referred as a pleasant experience.

As stated by other authors,[3] the pathologist´s experience is the most important factor in the diagnostic yield, and the small size of the samples can be organized as the major disadvantage of this procedure, yet the morbidity and mortality rates are less comparing it with open craniectomy biopsies.

Imperative to say that the procedure should be performed by an experienced and specialized team consisting of a neurosurgeon, in best case scenario a neuropathologist, and a neuroradiologist which can make a huge difference to implement some new sequences and visualization areas for instance in high grade astrocytoma.[5]

The presence of gliosis, necrosis, and hematoma can cause difficulties in establishing the histopathological diagnosis, and in some cases there´s no possibility of taking more samples to review it, yet the size of the biopsy material seems to be directly hemorrhaged related complications. We are at a new stereotactic multiplanar era and will be improving in better results for the neurosurgeon and of course for the patient itself.

The present study establishes that stereotactic biopsy is associated with an acceptable error in sampling, this included the chronic inflammation sample, but also states the importance of magnetic resonance image, which can lead to a precise diagnosis. Stereotactic biopsy ascertains the histological diagnosis of brain lesions with low risk and high accuracy. We also included children in our sample, as we can stablished that the stereotactic frame is safe in children, as stated by Furlanetti with his 99 consecutive cases.[6]

The stereotactic biopsy is a safe and efficient procedure, particularly in cases with lesions in which a craniotomy and surgery are not indicated primarily, although is safe efficient and valuable procedure, it has a morbidity rate ranging from 0.9 % to 15%, and mortality rate from 0 to 4.2%, but in a way the advances in the stereotactic

biopsy techniques decreased complications and increases the rate of conclusive diagnosis. In our sample we encounter hemorrhage visible in CT scan after 24 hours in 5 patients which is equivalent to 0.08%, no cause of death secondary to biopsy, 1 patient with acute renal failure. As stated by Riche[7] hemorrhage is the most common complication reported in published series. The rates vary from 0.9 to 8.6%

As demonstrated by Lin He[8] the brainstem stereotactic biopsy demonstrates striking accuracy plus satisfying safety in the diagnosis of brainstem lesions, the diagnostic yield, morbidity, and mortality mildly vary based on the diversity of assistant techniques and subject populations. For instance, in patients involving intracranial intraventricular tumors, the mortality rate was higher after biopsies than of all intracranial tumors. Comparison between endoscopic versus stereotactic biopsies was made in 2020, the results were similar, including the rates of total nondiagnostic biopsies and complications, the only possible advantage but not fully confirmed is the endoscopic ability to treat hydrocephalus.[9]

Finally in most studies, treatment decision for typical diffuse pontine glioma are based on MRI features alone and do not include histopathological diagnosis, several authors regard biopsy procedures for intrinsic brainstem tumors as being too dangerous and consider imaging methods as sufficiently reliable.[10]

Study Limitations: as we stated before the histopathological diagnosis is view dependent, therefore our 10 gliosis patients maybe by other neuropathologist seemed to be another diagnosis, that's one of the main points of our decrease in the correlation between our variables.

Conclusion

The value of stereotactic biopsy in the diagnosis of intrinsic mass lesions is valuable, with expert target point placement the biopsy sample is representative. Failure to make specific diagnosis was represented by 8.3% which led to fatal prognostic in 80% of the patients, in one case we found necrosis which should

mean we entered the lesion´s capsule and took only necrosis sample not the tumor per se. The correlation between magnetic resonance and histopathologic diagnosis were 74%, which is considered average. Histopathological diagnostic depends entirely on the pathology specialist, that's why we must have an initial guideline in this case the magnetic resonance, with the new techniques an variants we should make an initial magnetic resonance in every tumor, including ADC and spectroscopy, and maybe in some specific cases implement more efficient treatments, also the *O*-(2-[18F]fluoroethyl)-l-tyrosine F-FET application for differentiation between glioma malignancy.

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