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# FRAMELESS VERSUS FRAME-BASED STEREOTACTIC BRAIN BIOPSY

By

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## ABSTRACT

**Background:** There are several cost issues separating the use of surgical navigation systems and stereotactic frames for simple biopsy which may have implications in this era of health care cost control.

**Objective:** To evaluate the diagnostic, therapeutic role, efficacy, safety, complications and cost of stereotactic brain biopsy performed with a frameless versus a frame-based method.

**Patients and Methods:** This was a prospective study including 20 patients with deep seated brain lesion, morphological stereotactic surgeries performed with frame based stereotaxy (Group A) and frameless stereotaxy (Group B) as main management modality of their treatment, over two years from January 2019 to January 2021. All patients were examined and checked at Al-Azhar University Hospitals, Egypt. Data were collected regarding patient demographics, type of anesthesia, diagnostic yield, total operating room time, length of hospitalization and complication of the two procedures performed.

**Results:** There were no significant differences between the frame-based and frameless biopsy groups with regard to patient demographics, overall histopathology, proportion of nondiagnostic biopsies, incidence of complications. All the cases underwent frame-based stereotactic procedures done under local anesthesia, while the cases underwent frameless stereotactic procedures done under general anesthesia in 9 cases (90%), and local anesthesia in one case (10%). The total operating room time in frame-based biopsies ranged from 90 to 130 min (Mean 106.00, SD =14.30), while in frameless biopsies ranged from 120 to 195 min (Mean 167.00, SD = 22.75). The total time of hospitalization in frame-based stereotactic brain biopsy ranged from 1 to 3 days, mean 1.90+ SD = 0.56), while the total time of hospitalization in frameless stereotactic brain biopsy ranged from 3 to 8 days (Mean 5.1+ SD = 1.37).

**Conclusion:** Frame-based and frameless stereotactic biopsy approaches were equally effective at providing a tissue diagnosis with minimum morbidity and mortality. The frame-based approach, however, required significantly less anesthesia resources, less operating room time and shorter hospital stays, and thus should still be considered a first line approach for stereotactic brain biopsy.

**Keywords:** Stereotactic surgery, Frame based biopsy, Frameless biopsy, Diagnostic yield.

## INTRODUCTION

The term stereotaxy derives from two Greek roots "stereos" meaning solid and "takse" meaning arrangement. However in the past there has been at times passionate debate as to whether the correct adjective from stereotaxy should be stereotaxic or stereotactic *(Ganz, 2012)*. Clarke had the idea of defining the target point in space by 3 distances in relation to 3 orthogonal planes. The position of these planes was based on external anatomical landmarks *(Grunert et al., 2015).*

The use of stereotactic frames was later significantly expanded by Dr Lars Leksell, Professor of Neurosurgery, who also

modified the Horsley and Clarke device for use in functional neurosurgery. Leksell's frame consisted of a ''target centered'' arc-radius system where the probe was attached to an arc mounted on a movable frame. The probe could be moved along to the arc to almost any location *(Thomas and Sinclair, 2015).*

Further advancements of stereotactic brain surgery were possible through new diagnostic tools, such as computed tomography (CT), magnetic resonance imaging (MRI) and positron emission tomography (PET) Today frame-based stereotaxy still is seen as the "gold standard" for cerebral biopsies and for functional neurosurgery. Accuracy is high, and the technique is safe and reliable *(Gempt et al., 2012).*

Traditionally, frame-based techniques have been the standard method used to achieve a reliable and accurate sampling of intracranial lesions and have shown to be superior to freehand biopsy procedures in terms of morbidity, mortality, and diagnostic yield *(Zhang et al., 2013).* Frameless stereotaxy or neuronavigation was introduced more recently and has evolved into a new and feasible technology to acquire intracranial tissue samples, Although the more rigid frame used in frame-based stereotactic brain biopsy is considered to convey greater precision, particularly in targeting deep-seated lesions, only few studies have compared the two methods in terms of morbidity, mortality, and diagnostic yield *(Sciortino et al., 2019).*

Stereotactic brain biopsy is indicated when radiological diagnosis is uncertain and surgical resection is not feasible or advisable. For example if the lesion is deep-seated and or the patient has considerable comorbidity, increasing the risk of peri-operative or permanent morbidity, or even mortality *(Pasternak et al., 2020).* Frame-based image guided technologies have been mainstay in targeting deep structures in the brain in functional neurosurgery and in obtaining biopsies of deep brain tumors. Since the advent of frameless stereotactic systems, these technologies have come into greater use. In recent years, there has been controversy regarding which system is most accurate and cost-effective for biopsing brain lesions *(Vega et al., 2014).*

Stereotactic biopsy has been established as a standard diagnostic procedure in the treatment of patients with brain lesions, parenchymal hemorrhage occurring during or after surgery can lead to neurological deficits or even a fatal patient outcome *(Beynon et al., 2018).* Several factors may have a crucial impact on bleeding complications during stereotactic surgery. These factors include intraoperative trajectory planning to avoid cerebral vessel puncture, course of anesthesia, patient comorbidities and intravascular biology of tumours. Importantly, coagulopathy is considered a major risk factor for hemorrhage during surgery *(Kim et al., 2016).*

**The aim of this work was to** evaluate the diagnostic, therapeutic role, efficacy, safety, complications and cost of stereotactic brain biopsy performed with a frameless versus a frame-based method.

## PATIENTS AND METHODS

This is a prospective study including 20 patients with deep seated brain lesion, morphological stereotactic surgeries

performed with frame based stereotaxy (Group A) and frameless stereotaxy (Group B) as main management modality of their treatment, over two years from January 2019 to January 2021. All patients were examined and checked at Al-Azhar University Hospitals, Egypt. Data were collected regarding patient demographics, type of anesthesia, diagnostic yield, total operating room time, length of hospitalization and complication of the two procedures performed.

**Inclusion Criteria:**

1. Lesions in functionally critical areas, such as motor, sensory cortex.
2. Invasive neoplastic lesions without mass effect.
3. Small and deep seated lesions.
4. Multiple lesions.
5. Patients with poor medical conditions.
6. Patient with deep seated cyst.

**Exclusion Criteria:**

1. Suspected vascular lesions.
2. Very large brain lesions with significant mass effect.
3. Signs of tentorial herniation.

**Relatively Excluded criteria:**

1. Pediatrics age group as they cannot be assessed by both techniques to avoid statistical error.
2. Intracranial devices that interfere with target trajectory.

**All patients were subjected to the following aspects:**

**Clinical:**

A. History taking: Personal data, complaint, present, past and family history.

B. General examination: Vital data, chest, cardiovascular and abdominal examination.

C. Neurological examination: Level of consciousness, Cranial nerves, Superficial and deep sensation and Superficial and deep reflexes.

**Laboratory investigations:** CBC, Bleeding profile, (PT, PTT, INR), liver and kidney functions test and random blood glucose.

**Radiology:** CT Brain, MRI Brain, chest X-ray, abdominal ultrasonography and CT Angiography if suspected vascular lesion.

**Stereotactic procedures:**

According to the individual indication:

- Biopsy from lesion to verify the histological diagnosis.
- Drainage and aspiration of cystic lesions or abscess.

**Pathological examination:** Pathological examination of the biopsy material and grading according to WHO classification.

**Cytological examination:** Cytological examination of the aspirated fluid.

**Informed consent was obtained according to regulations of ethical committee.**

**Anesthesia:** Local anesthesia was used for all patients who performed frame-based stereotactic biopsy (Group A) with neuro anesthesiologists standing by; full cooperation of the patient was required. General anesthesia was used for patients

who performed Frameless stereotactic brain biopsy (Group B) except one case local anesthesia is used.

Post-operative CT usually performed 5 hours after procedure for documentation the accuracy and precision of an intervention. This allowed a comparison of the intended target coordinates with the actual target coordinates of the surgical intervention and for detection of suspected complications.

**Technique:**

1. Frame Based Stereotactic Brain Biobsy (Group A).

Procedures were performed using Leksell's frame "G" generation.

2. Frameless Stereotactic Brain Biobsy (Group B).

Procedures were performed using Neuronavigation stealth station.

**Statistical Analysis:**

Data were collected, coded, revised and entered to the Statistical Package for the Social Science (IBM SPSS) version 20. The data were presented as number and percentages for the qualitative data, mean, standard deviations and ranges for the quantitative data with parametric distribution and median with inter quartile range (IQR) for the quantitative data with non-parametric distribution. Chi-square test was used in the comparison between two groups with qualitative data and Fisher exact test was used instead of the Chi-square test when the expected count in any cell found less than 5. P value < 0.05 was considered significant.

## RESULTS

This study represented data from 20 patients underwent 20 stereotactic procedures, 10 patients done by frame-based stereotactic (Group A), and 10 patients done by frameless stereotactic (Group B). There were 10 patient done by frame-based stereotactic brain biopsy, the age of the patient ranged from 30 to 77 years (mean age 47.30, SD = 17.47). Male patients were 4 (40%), female patients were 6 (60%) and there were 10 patient done by frame less stereotactic brain biopsy. The age of the patient ranged from 25 to 64 years (mean age 47.10+ SD = 12.53) male patient 6 (60%), female patient 4 (40%). There was no statistically significant difference in demographic data both groups. Age (P = 0.977 and sex P = 0.371) **(Table 1)**.

**Table (1): Comparison between group A and group B as regards demographic data**

| Parameters \ Groups | | Group A (No.=10) | | Group B (No.=10) | | P value |
|---|---|---|---|---|---|---|
| | | No | % | No | % | |
| **Sex** | **Female** | 6 | 60.0% | 4 | 40.0% | 0.371 |
| | **Male** | 4 | 40.0% | 6 | 60.0% | |
| **Age** | **Mean ± SD** | 47.30 | 17.47 | 47.10 | 12.53 | 0.977 |

The most common site of the lesion in frame based stereotactic biopsy group was parietal lesion 3 case (30%), then thalamus 2 cases (20%), bithalamic and Lt basal ganglionic (10%), fronto-parietal(10%), midbrain, pons(10%), Pons (10%) and parieto- occipital (10%) while in frameless group, there were parietal in 7 cases (70%) then thalamus 2 cases (20%) and occipital (10%). There was no statistically significant difference in location regarding both groups (P = 0.369).

The most common presentation in frame-based stereotactic biopsy group was hemiparesis in 4 cases (40%), headache and blurring of vision in 4 cases (40%), hemiparesis, DCL in 1 case (10%) and paraesthsia and syncopal attack in one case (10%). In frameless stereotactic biopsy group hemiparesis was in 4 cases (40%), headache and blurring of vision in 3 cases (30%), dysphasia in 2 cases (20%) and decreased acuity of vision in one case (10%). There was no statistically significant difference in initial presentation regarding both groups (P = 0.399).

All lesions have characteristic radiology in T2 weighted image and flair except one case which lesion appear in T2 weighted image only, there was ring enhancement in 10 cases, 5 cases (50%) in frame-based group and 5 cases in frameless group, heterogeneous enhancement in 6 cases, 3 cases (30%) in frame-based group and 3 cases (30%) in frameless group, non-contrasted lesion was in 4 cases. 2 cases (20%). In frame-based group and 2 cases (20%) in frameless group. There was no statistically significant difference in radiological diagnosis regarding both groups (P = 0.305) **(Table 2)**.

**Table (2): Comparison between group A and group B as regards location of the lesion, initial symptoms and contrast enhancement**

| Parameters / Groups | | Group A (No.=10) | | Group B (No.=10) | | P-value |
|---|---|---|---|---|---|---|
| | | No | % | No | % | |
| Location | Bithalamic & Lt basal ganglionic | 1 | 10.0% | 0 | 0.0% | 0.369 |
| | Fronto- parietal | 1 | 10.0% | 0 | 0.0% | |
| | Midbrain, pons | 1 | 10.0% | 0 | 0.0% | |
| | Occipital | 0 | 0.0% | 1 | 10.0% | |
| | Parietal | 3 | 30.0% | 7 | 70.0% | |
| | Parieto- occipital | 1 | 10.0% | 0 | 0.0% | |
| | Pons | 1 | 10.0% | 0 | 0.0% | |
| | Thalamus | 2 | 20.0% | 2 | 20.0% | |
| Initial symptoms | Decreased acuity of vision | 0 | 0.0% | 1 | 10.0% | 0.399 |
| | Dysphasia | 0 | 0.0% | 2 | 20.0% | |
| | Headache, Blurring of vision | 4 | 40.0% | 3 | 30.0% | |
| | Hemiparesis | 4 | 40.0% | 4 | 40.0% | |
| | Hemiparesis, DCL | 1 | 10.0% | 0 | 0.0% | |
| | Paraesthesia & syncopal attacks | 1 | 10.0% | 0 | 0.0% | |
| Radiological Diagnosis | T2WI | 1 | 10.0% | 0 | 0.0% | 0.305 |
| | T2WI and Flair | 9 | 90.0% | 10 | 100.0% | |
| Contrast enhancement | Heterogeneous enhancement | 2 | 20.0% | 2 | 20.0% | 1.000 |
| | non contrasted | 3 | 30.0% | 3 | 30.0% | |
| | Ring enhancement | 5 | 50.0% | 5 | 50.0% | |

According to histological diagnosis and diagnostic yield, in the frame-based group, the histological diagnosis was in 9 case (90%), astrocytoma grade II (20%), cystic astrocytoma grade II (10%), fibrallary astrocytoma grade II(10%), glioblastoma multiform grade IV(10%), glioma (10%), brain abscess (20%), metastasis (10%), non-diagnostic sample in one case (10%) with diagnostic yield 90%. In frameless group glioblastoma multiform grade IV (30%), astrocytoma grade II (30%), anaplastic astrocytoma grade II (10%), brain abscess (10%), metastasis (10%) non diagnostic sample in 1 case (10%) with diagnostic yield 90%. There was no statistically significant difference in histological diagnosis and diagnostic yield regarding studied group (P = 0.699) **(Table 3)**.

According to anesthesia, in the frame-based stereotactic brain biopsy, all were done under local anesthesia (100%), while in frameless stereotactic brain biopsy general anesthesia was done in 9 cases (90%) and local anesthesia in one case (10%). There was a statistically significant increase local anesthesia in frame-based stereotactic group (P < 0.001) **(Table 3)**.

**Table (3): Comparison between group A and group B as regards diagnostic yield, histological diagnosis and anesthesia**

| Parameters \ Groups | | Group A (No.=10) | | Group B (No.=10) | | P value |
|---|---|---|---|---|---|---|
| | | No | % | No | % | |
| **Histological diagnosis** | | 9 | 90% | 9 | 90% | 1.000 |
| **Non diagnostic Biopsy** | | 1 | 10.0% | 1 | 10.0% | |
| **Histological diagnosis** | **Anaplastic Astrocytoma grade III** | 0 | 0.0% | 1 | 10.0% | 0.699 |
| | **Astrocytoma grade II** | 2 | 20.0% | 3 | 30.0% | |
| | **Brain Abscess** | 2 | 20.0% | 1 | 10.0% | |
| | **Cystic Astrocytoma grade II** | 1 | 10.0% | 0 | 0.0% | |
| | **Fibrallary Astrocytoma grade II** | 1 | 10.0% | 0 | 0.0% | |
| | **Glioblastoma Multiform grade IV** | 1 | 10.0% | 3 | 30.0% | |
| | **Glioma** | 1 | 10.0% | 0 | 0.0% | |
| | **metastasis** | 1 | 10.0% | 1 | 10.0% | |
| | **Non diagnostic Biopsy** | 1 | 10.0% | 1 | 10.0% | |
| **Anesthesia** | **General** | 0 | 0.0% | 9 | 90.0% | <0.001 |
| | **Local** | 10 | 100.0% | 1 | 10.0% | |

According to the total operating room time in the frame-based stereotactic brain biopsy ranged from 90 to 130 min (Mean 106.00+ SD =14.30), while total operating room time in the frameless stereotactic brain biopsy ranged from 120 to 195 min (Mean 167.00+ SD = 22.75). There was a statistically significant decrease in group A in comparison to group B regarding total operating room time (P < 0.001). The total time of hospitalization in frame-based stereotactic brain biopsy ranged from 1 to 3 days (Mean 1.90+SD = 0.56), while the total time of hospitalization in frameless stereotactic brain biopsy ranged from 3 to 8 days (Mean 5.1+ SD = 1.37),

there was statistically significant less time for the patients who underwent Frame-based biopsy compared to those who underwent frameless biopsy (P = 0.001) **(Table 4)**.

According to complications in the frame-based stereotactic brain biopsy, there was a complication in one case (10%), patient has minimal subarchnoid hemorrhage post-operative, while in the frameless stereotactic brain biopsy there were complications in 2 cases (20%), one patient had fits post-operative, and one patient had intracerebral hemorrhage. Follow up of the complications were done, and all patient discharged from hospital. There was no statistically significant difference in complications regarding studied group (P = 0.383) **(Table 4)**.

**Table (4): Comparison between group A and group B as regards length of hospitalization (days), total operating room time (min) and complications**

| Parameters \ Groups | | Group A (No.=10) | | Group B (No.=10) | | P value |
|---|---|---|---|---|---|---|
| | | No | % | No | % | |
| Length of hospitalization (days) | One day | 2 | 20.0% | 0 | 0.0% | 0.006 |
| | Two days | 7 | 70.0% | 0 | 0.0% | |
| | Three days | 1 | 10.0% | 1 | 10.0% | |
| | Four days | 0 | 0.0% | 2 | 20.0% | |
| | Five days | 0 | 0.0% | 4 | 40.0% | |
| | Six days | 0 | 0.0% | 2 | 20.0% | |
| | Eight days | 0 | 0.0% | 1 | 10.0% | |
| | Mean ± SD | 1.90 | 0.56 | 5.1 | 1.37 | 0.001 |
| Total Operating Room time (Min) | Mean ± SD | 106.00 | 14.30 | 167.00 | 22.75 | <0.001 |
| Complications | Fits | 0 | 0.0% | 1 | 10.0% | 0.383 |
| | Intracerebral hemorrhage | 0 | 0.0% | 1 | 10.0% | |
| | Minimal Subarachnoid hemorrhage | 1 | 10.0% | 0 | 0.0% | |
| | None | 9 | 90.0% | 8 | 80.0% | |

## DISCUSSION

There was no statistically significant difference in demographic data regarding both groups. This was correlated with *Dammers et al. (2010)* who reported comparing frame-based and frameless biopsy methods. *Lu et al. (2015)* found that the frame-based and frameless biopsy groups did not differ significantly with respect to patient age, gender.

The most common site of the lesion in frame based stereotactic biopsy group was parietal lesion 30%, while in frameless group was parietal in 70%. There was no statistically significant difference in location regarding both groups. This was correlated with *Mansour (2018)* who reported that deep thalamic lesions were the most frequently encountered location of lesions biopsied. This was correlated with *Dammers et al. (2010)* who reported that the anatomical site of the lesion might

have consequences for both the diagnostic yield and the risk for complications. A deep-seated midline or cerebellar location was associated with a higher rate of not obtaining a diagnosis on histopathologic examination. Furthermore, deep-seated lesions in the basal ganglia and thalamus were more at risk of biopsy-related death, due to postoperative symptomatic haemorrhage and or edema.

In this study all lesions have characteristic radiology in T2 weighted image and flair except one case which lesion appear in T2 weighted image only, there was ring enhancement in 10 cases, 5 cases (50%) in frame-based group and 5 cases in Frameless group, Heterogeneous enhancement in 6 cases, 3 cases (30%) in frame-based group and 3 cases (30%) in frameless group, non-contrasted lesion was in 4 cases. 2 cases (20%) in frame-based group and 2 cases (20%) in frameless group. There was no statistically significant difference in Radiological Diagnosis regarding both group (P = 0.305). This was correlated with *Lu et al. (2015)* who reported that Image Characteristics of lesions with T1 contrast enhancement on MRI scan, 89.7% (218 of 243) had a definitive diagnosis, while 82.5% (33 of 40) of lesions without enhancement had a definitive diagnosis. The difference was not statistically significant .

In this study, in the frame-based group. the histological diagnosis was in 9 cases (90%), non-diagnostic sample in one case (10%) with diagnostic yield 90% while in frameless group non diagnostic sample in one case (10%) with diagnostic yield 90%. There was no statistically significant difference in histological diagnosis and diagnostic yield regarding studied group .

This was correlated with *Lu et al. (2015)* who reported that the overall diagnostic yield was 87.8%. In the frame-based group, a definitive diagnosis was obtained in 60 of 63 cases (95.2%). In the frameless group, a definitive diagnosis was obtained in 101 of 113 cases (89.4%). Comparing across groups, no statistically significant difference was found in diagnostic yield between frame-based and frameless biopsies.

This was correlated with *Mansour (2018)* who found that all cases, but 4, the lesions were accurately targeted. The incidence of miss targeting was (4/200= 2%) of the studied patients, which was noticed among the diagnostic group (2/180 = 0.011%) more than the therapeutic group (2/20=10%). He reported that Targeting accuracy was calculated as the percentage of cases when tissues were from the area targeted, confirmed either by a definite histopathological diagnosis or a post-operative CT clearly showing the site of the biopsy within the body of the lesion. The signs confirming accurate lesion targeting may be one or more of the following: hyperdense sign denoting blood inside the lesion caused by the needle, hypodense sign denoting air dots inside the lesion or aspiration of abnormal cystic content.

In this study, in the frame-based stereotactic brain biopsy all was done under local anesthesia (100%) while in frameless stereotactic brain biopsy general anesthesia was done in 9 cases (90%) and local anesthesia in one case (10%). There was statistically significant increase local

anesthesia in frame-based stereotactic group . This was correlated with *Dammers et al. (2010)* who reported a total of 227 frame-based stereotactic brain biopsy procedures were performed under local anesthesia with minimal sedation was employed except for a few agitated patients for whom general anesthesia was used, Frameless stereotactic procedures were performed under general anesthesia.

In this study, the total operating room time in the frame-based stereotactic brain Biopsy ranged from 90 to 130 min (Mean 106.00, SD =14.30), while total operating room time in the frameless stereotactic brain biopsy ranged from 120 to 195 min (Mean 167.00, SD = 22.75) There was a statistically significant decrease in group A in comparison to group B regarding total operating room time. This was correlated with *Smith et al. (2011)* who found that frame-based stereotactic biopsy required significantly less operating room time than frameless stereotactic biopsy. Frame-based biopsies required 114 ± 3 (SD = 39) min of total operating room time, while frameless biopsies required 185 ± 6 (SD = 52) min .

The total time of hospitalization in frame-based stereotactic brain biopsy ranged from 1 to 3 days (Mean 1.90, SD = 0.56) while the total time of hospitalization in frameless stereotactic brain biopsy ranged from 3 to 8 days (Mean 5.1, SD = 1.37). There was a statistically significant less time for the patients who underwent frame-based biopsy compared to those who underwent frameless biopsy. This was correlated with *Smith et al. (2011)* who reported that the total time of hospitalization and the time of hospitalization following the biopsy procedure were significantly less for the patients who underwent frame-based biopsy vs. those who underwent frameless biopsy. It is possible that the use of general anesthesia for the frameless biopsy patients contributed to these longer hospital stays.

In the frame-based stereotactic brain biopsy, there was a complication in one case (10%), patient has minimal subarchnoid hemorrhage post-operative, while in the frameless stereotactic brain biopsy there was complication in 2 cases (20%), one patient had fits post-operative, one patient had intracerebral hemorrhage. Follow up of the complication done, all patients were discharged from hospital. There was no statistically significant difference in complications regarding studied group. This was correlated with *Lu et al. (2015)* who found 19% with complications (20.6%) had complications compared with 19.6% frameless biopsies and 17.7% intraoperative MRI guided biopsies. There was no statistically significant difference for the complication rate among all 3 biopsy methods .

## CONCLUSION

There were three considerable differences between the two procedures: The frame-based biopsy procedure was readily performed with local anesthesia and a mild sedative and rarely required general anesthesia, while the frameless approach typically required general anesthesia, due to Mayfield head fixation. Operating room time, intra-operative set-up time, and incision-to-closure time were significantly less for the frame-based procedure. The increased operating room time required for frameless biopsy did not appear to result from the level of

experience with this newer technology, since the corresponding learning curve appearses to be relatively flat over a several year period. Patients who underwent frame-based biopsy required significantly shorter hospital stays than did those who underwent frameless image-guided biopsy. This latter observation was likely due, at least in part, to the ability to readily perform frame-based biopsy without general anesthesia.

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# مقارنة بين إستخدام جهاز الإبحار الجراحى والمنظور ثلاثى الأبعاد فى عينات أمراض المخ

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**خلفيـــة البحـــث:** هنـــاك العديـــد مـــن مشـــكلات التكلفـــة التـــي تفصـــل بـــين اســـتخدام أنظمـــة الملاحـــة الجراحيـــة والمنظـــور ثلاثـــى الابعـــاد للخزعـــة البســـيطة والتـــي قـــد يكـــون لهـــا آثـــار في هذا العصر من التحكم في تكلفة الرعاية الصحية.

**الهـــدف مـــن البحـــث:** تقيـــيم الـــدور التشخيصـــي والعلاجـــي والفعاليـــة والســـلامة والمضـــاعفات وتكلفـــة عينـــة أمـــراض المـــخ التجســـيمية التـــي يـــتم إجراؤهـــا باســـتخدام جهاز الإبحار الجراحى مقارنة بالمنظور ثلاثى الأبعاد.

**المرضـــى و طـــرق البحـــث:** يشـــمل البحـــث 20 مريضًـــا يعـــانون مـــن أورام بـــالمخ، حيـــث تـــم إجـــراء العمليـــات الجراحيـــة لأخـــذ عينـــات مـــن الـــورم ســـواء باســـتخدام المنظـــور ثلاثـــى الأبعـــاد (المجموعـــة أ) و جهـــاز الإبحـــار الجراحـــى (المجموعـــة ب) ضـــمن خطـــة العـــلاج، علـــى مـــدار عـــامين مـــن ينـــاير 2019 إلـــى ينـــاير2021، وقـــد تـــم فحـــص جميـــع المرضـــى فـــي مستشـــفيات جامعـــة الأزهـــر، وتـــم جمـــع البيانـــات الخاصـــة بالســـن والنـــوع لكـــل مـــريض، ونـــوع التخـــدير، وعائـــد التشـــخيص، وإجمـــالي وقـــت غرفـــة العمليـــات، ومدة الحجز داخل المستشفى، والمضاعفات بعد الجراحة.

**نتـــائج البحـــث:** لـــم يوجـــد فـــرق واضـــح إحصـــائيا بـــين مجمـــوعتي المنظـــور ثلاثـــى الأبعـــاد و جهـــاز الإبحـــار الجراحـــى فيمـــا يتعلـــق بالعمروالســـن للمـــريض، ونتـــائج تشـــخيص الأنســـجة، ونســـبة العينـــات غيـــر التشخيصـــية، ونســـبة حـــدوث المضـــاعفات، وجميـــع الحـــالات التـــى أجريـــت بواســـطة المنظـــور ثلاثـــى الابعـــاد تـــم إجرائهـــا تحـــت التخـــدير الموضـــعي، بينمـــا الحـــالات التـــى أجريـــت بواســـطة جهازالإبحـــارالجراحى تـــم الإجـــراء تحـــت التخـــدير العـــام فـــى 9 حـــالات (90٪)، وتحـــت التخـــدير الموضـــعي فـــي حالـــة واحـــدة (10٪)، وتـــراوح إجمـــالي وقـــت غرفـــة العمليـــات فـــي المنظـــور ثلاثـــى الأبعـــاد مـــن 90 إلـــى 130 دقيقـــة (المتوســـط 106، معـــدل الأنحـــراف = 14.30)، بينمـــا تـــراوح

إجمالي وقت غرفة العمليات فى جهاز الإبحار الجراحى من 120 إلى 195 دقيقة (المتوسط 167 ، معدل الإنحراف = 22.75)، وتراوح إجمالي مدة الحجز داخل المستشفى في حالات المنظور ثلاثى الابعاد من 1 إلى 3 أيام (المتوسط 1.90، معدل الإنحراف = 0.56) بينما تراوحت مدة الحجز داخل المستشفى في حالات جهازالإبحارالجراحى من 3 إلى 8 أيام (المتوسط 5.1، معدل الإنحراف = 1.37).

**الإستنتاج:** عينات أورام المخ بواسطة المنظور ثلاثى الأبعاد و جهاز الإبحار الجراحى لها نفس الإمكانية في توفير تشخيص الأنسجة مع الحد الأدنى من المضاعفات والوفيات. ومع ذلك، فإن استخدام المنظور ثلاثى الأبعاد يتطلب موارد تخدير أقل بشكل ملحوظ، ووقت أقل في غرفة العمليات و أقل فى مدة الحجز في المستشفى، وبالتالي يجب إعتباره الخط الأول فى عينات أورام المخ.

**الكلمات الدالة:** جراحة التوضيع التجسيمي، خزعة الإطار، خزعة بدون إطار، عائد تشخيصي.