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# Mucous Extractor for Tumor Tissue Sampling in Neurosurgery

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## Abstract

**Objective** Collection of sample for histopathological analysis is highly important during any surgical procedure. The histopathology report helps determine the diagnosis, prognosis further management, and follow-up plan. The use of a reliable sample collection technique is doubly important in neurosurgical procedures because lesions are often deep-seated and difficult to access.

**Materials and Methods** Conventional techniques of sample collection, such as use of tumor-grasping forceps and collection of material from the ultrasonic aspirator device suffer from limitations of access and unreliability. We propose a novel technique of sample collection using readily available mucous aspirator device.

**Results** This device is economical, sterile, and disposable. It can be used even in low-resource settings because it is easily available. It can also be connected to suction cannula and the negative pressure settings can be adjusted as required.

**Conclusion** The use of this device for neurosurgical procedures has been tried in the transcranial and transnasal neurosurgical procedures and found to be effective. The sample collected in the canister of the mucous aspirator can be directly sent to the laboratory for histopathological analysis.

**Keywords**
- biopsy
- neuro-oncology
- histopathological analysis
- mucous aspirator

## Introduction

A large proportion of neurosurgical procedures are performed for excision and/or biopsy of space-occupying lesions in the brain and spinal cord. This requires adequate surgical exposure, deciding the appropriate surgical approach, collecting tissue sample for histopathological analysis, and surgical excision or decompression of the lesion. Collection of an adequate biopsy sample is highly important because histopathological analysis of the tumor tissue determines further treatment, follow up, and prognosis.

The conventional technique for collecting tissue sample is by manually taking tissue bits using a tumor biopsy forceps or similar such instrument. Alternatively, tumor tissue is sometimes collected from the canister attached to an ultrasonic aspirator device used for tumor excision. Both these techniques suffer from certain limitations, as we shall subsequently discuss and further refinements to the technique of biopsy sample collection are desired.

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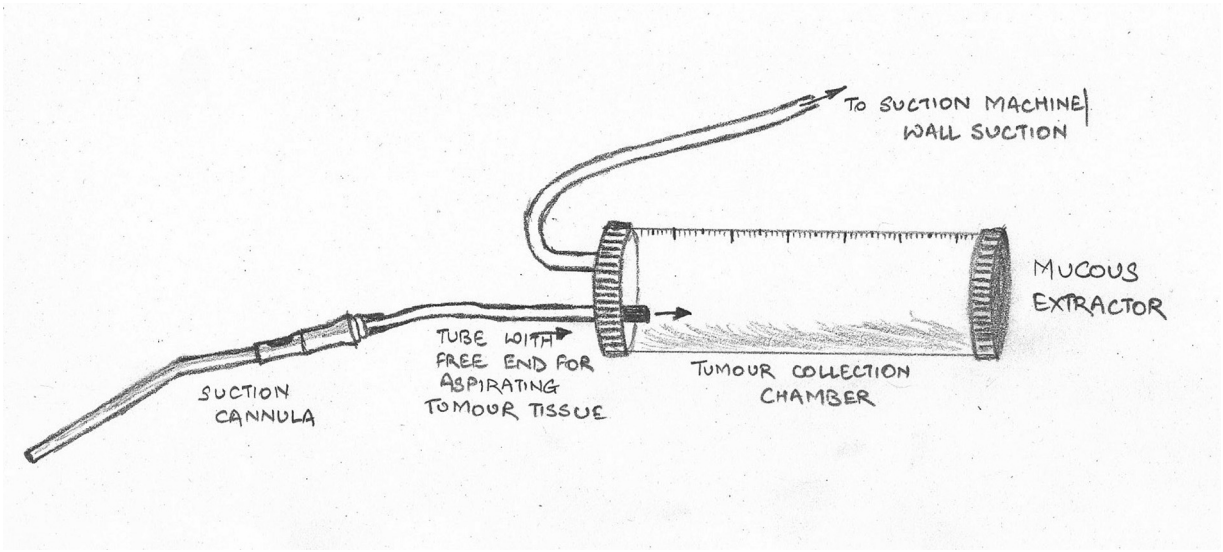


**Fig. 1** Hand-drawn diagram showing the various parts of the mucous extractor device and its application for suction biopsy.

A tumor collection chamber has previously been described, which uses a glass or plastic container to which the negative pressure suction tubing is connected.[1] We propose the use of the readily available mucous extractor device for collecting tissue sample for difficult-to-access lesions. A negative pressure suction device can be attached to this mucous extractor, while the other tubing (►**Fig. 1**) can be used to either directly aspirate tumor tissue (using its flexible tubing) or it can be connected to a metal suction cannula (►**Fig. 2**).

## Technical Details

A mucous extractor device is an economical, disposable, and sterile equipment that is readily available in hospitals and pharmacies across all socio-economic settings worldwide. It has a plastic, transparent chamber of 25 mL capacity. There are two tubes attached to the chamber on the same side (►**Fig. 2**), one which is connected to the suction machine or wall suction and the other is a free end used for suctioning at the site of interest. This free end tube has a length of 35 to 40 cm in most commercially available mucous extractors. The suction tube creates a negative pressure within the plastic container, which in turn creates a negative pressure suction effect at the free end of the other tube.

When using this for tumor tissue sampling, the free tube is either directly passed until the tumor in the surgical space, or connected to a metal suction cannula (using a rubber connector). Due to the negative pressure generated at the tip of the free tube, an easily or partially suckable tumor is readily collected into the chamber of the mucous extractor. Because the other tube connected to the suction machine is also attached to the same side of the mucous extractor, the tumor tissue does not get sucked out of the chamber. This

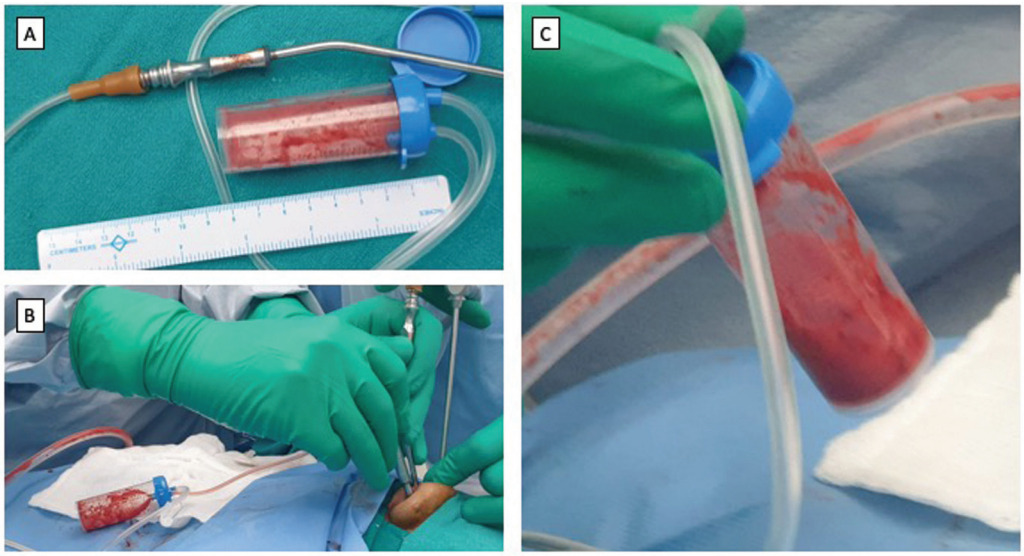


**Fig. 2** (**A**) Commercially-available mucous extractor device. (**B**) Application and use of the device during a transnasal pituitary tumor excision procedure. (**C**) Sample collected in the canister of the mucous extractor device.

 

sterile container can then be directly used to send the tissue sample to the laboratory for histopathological examination.

The apparatus is sterile and disposable. It can be discarded after a single use because it is also economical (less than 100 rupees in India). If it has to be reused, it can be thoroughly cleaned and sterilized using ethylene oxide (ETO).

We have used this mucous extractor for tissue sampling for transnasal pituitary tumor excision and for transcranial surgeries and found that adequate tissue is reliably collected for histopathological analysis.

## Discussion

Neurosurgical space-occupying lesions are usually resected piecemeal and not en-bloc as in other anatomical regions. Tumor tissue is conventionally taken manually using a tumor biopsy or tissue grasping forceps. However, these bayonet-shaped forceps suffer from a limitation of access, especially for deeply situated tumors, such as pituitary adenomas, intraventricular tumors, or pineal region tumors. This repeated action for collecting lesions also distracts attention and takes additional time.[1] Moreover, soft and suckable lesions (tumors, granulation tissue, etc.) may not be adequately picked with tumor-holding forceps and are aspirated using suction.

The other commonly used biopsy sampling technique is by using an ultrasonic aspirator in which the lesion tissue is delivered into the canister of the suction system. Tissue fragments collected using an ultrasonic aspirator have been shown to be representative and reliable for histopathological diagnosis.[2] However, this gets mixed with other surgical aspirates such as blood, brain tissue, bone dust, muscle and fat. It has also been found that ultrasonic aspirators generate a spray of aerosolized irrigating fluid around the instrument tip. This fluid may contain intact tumor cells and may further disperse them to other intact and virgin areas around the tumor.[3]

The mucous extractor apparatus is readily available. It is primarily used for tracheal suctioning and for collecting tracheal aspirate for microbiological analysis. Since it is sterile, disposable and economical, it is one-time-use device. Its other applications have been to suction out regurgitated material and prevent aspiration pneumonitis.[4]

Collection of tumor specimen for histopathological analysis is of paramount importance for diagnosis, management and prognostication. Design for a tumor collection chamber has been previously proposed.[1] This prototype design involved a suction tubing for collection of solid tumors by selectively allowing the suction flow through the tumor collection chamber (TCC). A wire mesh was placed at one end of the chamber to allow blood and irrigation fluid to be passed into the suction tubing, while letting the solid tumor tissue collect inside the chamber. This was tried and found to be effective for collection of tumor tissue. However, there were certain limitations felt with their design of TCC.

Proper cleaning and sterilizations were required for reuse, which can be circumvented using a disposable and sterile mucous extractor. If a tubing gets blocked by the aspirate, part of its length can be cut or a new one can be used, and surgical time of cleaning can be saved. Moreover, because the mucous extractor has both tubes at the same end of the chamber, an adequate negative pressure is generated, but tumor tissue does not easily get sucked into the suction machine and is more reliably retained within the chamber. Even cystic and semi-solid materials can be collected unlike with the old design of TCC, where they may pass through the wire mesh. The negative pressure in the mucous extractor can also be controlled, either using a commercially available suction regulator, changing the settings on the suction machine, or using indigenously developed suction pressure control valves.[5]

To conclude, the mucous extractor and the technique described, provide a novel and effective method for tissue sampling for neurosurgical lesions, especially in areas where biopsy forceps cannot easily be passed. It's easy availability and cost-effectiveness make it an attractive tool in the armamentarium of neurosurgeons.

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Conflict of Interest
None declared.

Authors' Contributors
JR contributed to conceptualization, writing, and editing. JSG contributed to writing and editing. MG contributed to editing, proofreading, and surgery. DKJ contributed to conceptualization, editing, and supervision. MK and KK were part of the surgery team.

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