REVIEW ON CYTOSPONGE- A GAME- CHANGER SPONGE CHECKS OESOPHAGUS CANCER EARLY

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ABSTRACT:

Cytosponge is a device that is not invasive and is the same size as regular tablets, and is used instead of them. In certain areas of detection, endoscopy is utilized because it is accurate, safe, and affordable compared to other methods endoscopy. The pill being attached to a string and taken with water makes it known as'sponge on a string'.The application of the cytosponge and subsequent discomfort during and after 3 to 5 days can be alleviated with the use of Lidocaine throat spray. Using the string, you can withdraw within 5 minutes. A capsule measuring 8.5 mm in diameter is the result of polyester sponge material being compressed. The gelatin-encased outer layer is attached to a 70mm long string and has a diameter of 25 mm. It is distributed to them If a patient has enough water, the gelatin portion will disappear when the cytosponde reaches the stomach.

It Accumulates roughly one million cells from the oral cavity and stomach, including Fusobacterium, Megasphaera, and Campylobacter. Capnocytophaga, and Dialister. To determine their viability, the cells are isolated and tested. TFF3, Aura-k, and TFPI2 can be used to detect malignant or normal conditions. TWIST1, ZNF345, and ZNF569. TFF3 is commonly employed as a biomarker. The detection of Barrett's is achieved by using cytosponge The symptoms of obesity, eosinophilic esophagitis, oesophageal microbiota, and precancerous mucosal changes like gastric intestinal are present. GIM, GA, Esophageal dysplasia, other gastrointestinal pathologies, and Esophageal Diseases, and H. pylori. During the COVID-19 pandemic, it is also employed for gastrointestinal endoscopic procedures. New research is the use of AI and cytosponge technologyisbeing utilized.

KeyWords:- cytospong, , eosinophilic, sponge

INTRODUCTION:-

In united kingdom, there is a high incidence of oesophageal adenocarcinoma [OAC] this is the seventh most prevalent cause of cancer death. It has gloomy out look with a 5-year net survival rate of only 17%. Barrets oesophagus is the precursur to OAC cases. Which provide an oppurtunity for early detection besides age,sex[male], ethinicity[caucasian] and family history. Gastro-oesophageal reflex is the most important cause of BO. Presently, only available 20% of BO paqtients are diagnosed. since, endoscopy is not aviable option for all patients with GORD[Gastro oesophageal reflex disease]. GORD is not a universal treament for all patients. Not all patients with GORD experience heart burn symptoms and so they may not get medical attention. Currently there are several non-endoscopic cell collection devices rather than endoscopy based screening modalities due to low cost. Cytosponge was initially utilized as a screening methods for OSCC[oesophageal squamous cell carcinoma], but it failed due to

the reliance on cytological assessment of atypia.

The combination of cytosponge with a biomaker gives more ease of detection of barrets oesophgeous. The standard cytological analysis used in the initial study was unsuccessful due to the difficulties in interpreting cell atypia and low cell yield. However, after the rapid improvement of biomaker technologies is causing a resurgence in interest in non endoscopy. the detection sensitivity is high and can we easily implemented in ahigh through out environment. This device has been proven to be successful after being combined with a biomarker. The development of cytosponges occured at cambridge university [Medical research and council, london, uk] the world has been it's first use of "sponge in a string" at a british hospital to detect oesophageal cancer using a method that is covid safe.

Health workers do not employe endoscopy, sedation or biopsy when collecting cell samples from the oesophgus. Endoscopy was halted during a pandemic due to the potential for the virus to be sprayed in to the air. Consequently the patient was switched to the cytosponge that is consider as break through. It is quick and cost effective and the usual standard of care will be implemented, which will be more efficient. This device is minimally invasive and has the appearance of a pill. the TFF3 [trefoil factor 3] biomarker can help triage endoscopy in conjuction with oesophagus cancer. A capsule measuring 8.5mm diameter and 25mm in length is made up of poly ester string gelatin vegetables derivative is what's makes up the capsule, and it disintegrates in the stomach within 3-5 mimutes.

The cost effectiveness analysis were carried out from the stand point of society. Literature was used to obtain cost for cancer treatment. There is a lack of empirical data because cytosponge technology is a new and not at commercially available. A wide range of variables were used to conduct a pivotal sensitivity analysis of cytosponges. The uncertainity of this parameters makes it possible to estimate it in a probabilistic manner. Ptient who undergo endoscopic screening would see a significant decrase in symtometic oesophageal adenocarcinomas after elective screening for dysplasia or intramucosal cancer. The grater benefit for cytosponge is dependent on the number of patients who accepts screening for cytosponge compared to screening by endoscopy. The cost of treating dysplasia lessions or intramucosal cancer after cytosponge screening was estimated to be greater than that of screening alone.

PATHOLOGY OF OESOPHAGUS CANCER

Progression from Barrett's Esophagus to Esophageal Cancer

1. Chronic Gastroesophageal Reflux Disease (GERD): Prolonged exposure to acidic stomach contents damages the esophageal lining.

2. Barrett's Esophagus: The damaged esophageal lining is replaced by metaplastic columnar epithelium, which is more resistant to acid but has an increased risk of neoplastic transformation.

3. Dysplasia: Genetic mutations accumulate in the Barrett's epithelium, leading to dysplastic changes, which are precancerous.

4. Adenocarcinoma: Dysplastic cells progress to invasive adenocarcinoma, which can infiltrate the esophageal wall and metastasize to lymph nodes and distant organs.

Pathological Features of Esophageal Cancer Arising from Barrett's Esophagus

1. Adenocarcinoma: The most common histological type, accounting for approximately 80% of cases.

2. Tumor Location: Typically arises in the distal esophagus, near the gastroesophageal junction.

3. Tumor Size and Depth: Can vary, but often invades the muscularis mucosae and submucosa.

4. Lymph Node Involvement: Common, with metastases often found in periesophageal, gastric, and celiac lymph nodes.

5. Distant Metastases: Can occur, particularly to the liver, lungs, and bones.

Molecular Pathogenesis:

1. Genetic Mutations: TP53, CDKN2A, and SMAD4 are commonly mutated in esophageal adenocarcinoma.

2. Epigenetic Alterations: Promoter methylation and histone modifications contribute to gene silencing and tumorigenesis.

3. Signaling Pathways: Activation of the WNT/β-catenin, PI3K/AKT, and MAPK/ERK pathways promotes cell proliferation, survival, and invasion.

Immunohistochemical Markers:

1. CK7 and CK20: Positive in esophageal adenocarcinoma, helping to distinguish it from squamous cell carcinoma.

2. p53: Overexpression is common in esophageal adenocarcinoma, indicating TP53 mutation.

3. Ki-67: High proliferation index is often seen in esophageal adenocarcinoma.

Grading and Staging

1. Grading: Esophageal adenocarcinoma is graded based on the degree of differentiation, with well-differentiated (G1), moderately differentiated (G2), and poorly differentiated (G3) tumors.

2. Staging: The TNM staging system is used, with T (tumor size and depth), N (lymph node involvement), and M (distant metastases) components.

Prognostic Factors:

1. Tumor stage: Advanced tumor stage is associated with poorer prognosis.

2. Lymph node involvement: Presence of lymph node metastases is a poor prognostic factor.

3. Distant metastases: Presence of distant metastases is associated with poorer prognosis.

4. Grade: Poorly differentiated tumors have a worse prognosis than well-differentiated tumors.`

HOW IT WORKS:

The cytosponge is composed of a pill shaped substance with a thread that the patient swallows. The capsule dissolves in the stomach and releases a small spongy ball. The cytosponge is re introduced back to the throat by a medic, typically a nurse by pulling the string. It may feel rough, but this quick. Cells are collected by the cytosponge from the oesophagus lining during its journey. The cytosponge cells are examined in a laboratory to detect abnormal cells that may indicate cancer. Abnormal barrets cells are stained brown by the TFF3 test developed by the team. If there are no abnormal cells there is no need for further investigations, which means there is no need for an invasive endoscopy

INGESTION: A capsule that is attactches to a string is swallowed hy the patient during ingestion a compressed sponge is contained within the capsule.

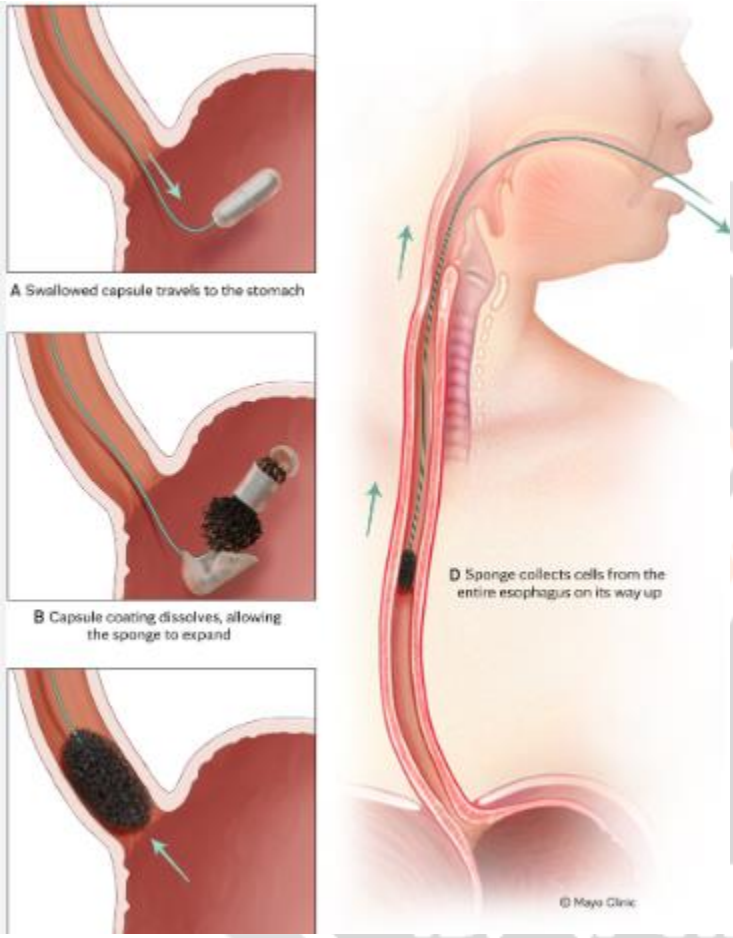
EXPANSION: The capsule dissolves in the stomach enabling once it reaches there

RETRIEVAL: using the string the sponge is gently pulled up out of the esophagus after a few minutes of retieval. During its journey it collects cells from the esophagus lining.

ANALYSIS: The collected cells undergo laboratory analysis to identifty biomarkers associated with barrets esophagus and other conditions.

Taking sponge in:

Patients experience a great deal of suprise when they handkle cytosponge as they anticipate it to be much larger in size. Whenever they employ initially they believed that the cytosponge would be much bigger. In reality cytosponge is identical and the size of the cytosponge capsule is similar to that of regular tablets, which means the patients will not experience of any problems when taking it.



Taking out the sponge:

After exposure of the expanded cytosponge some patients experienced then they had expected. They are worried that the cytosponge could cause damage to their oesophagus, there were individuals who believed that choking was a possibility of cytosponge causes vomithing. Cytosponge can come in to contact with the oesophagus or stomach if the string braks this was concerbn that was a common issue.

BENEFITS:

The Cytosponge test is a relatively new, non-invasive, and pain-free diagnostic tool used to detect Barrett's esophagus and esophageal cancer. Here are some benefits of the Cytosponge test:

Patient Benefits:

1. Non-invasive: The test is done through the mouth, eliminating the need for endoscopy or surgery.

2. Pain-free: The Cytosponge is swallowed, and the collection of cells is done without causing discomfort.

3. Quick procedure:The test takes around 10-15 minutes to complete.

4. Reduced risk of complications: Compared to traditional endoscopy, the Cytosponge test has a lower risk of complications.

Diagnostic Benefits:

1. Improved accuracy: The Cytosponge test can detect Barrett's esophagus and esophageal cancer with high accuracy.

2. Early detection: The test can identify abnormalities in the esophagus at an early stage, allowing for timely treatment.

3. Reduced need for endoscopy: The Cytosponge test can help identify patients who do not require endoscopy, reducing unnecessary procedures

Clinical Advantages

1. Increased patient compliance: The non-invasive nature of the test may encourage more patients to undergo screening.

2. Cost-effective: The Cytosponge test is potentially more cost-effective than traditional endoscopy.

3. Easy to perform: The test can be performed in a doctor's office or clinic, making it more accessible to patients.

Research Advantages:

1. Biomarker discovery: The Cytosponge test can help identify biomarkers for Barrett's esophagus and esophageal cancer.

2. Monitoring disease progression: The test can be used to monitor disease progression and response to treatment.

3. Personalized medicine: The Cytosponge test can help personalize treatment plans for patients with Barrett's esophagus and esophageal cancer.

ADVANTAGES:

Patient-Centric Advantages:

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2. Pain-free: The Cytosponge is swallowed, and the collection of cells is done without causing discomfort.

3. Quick procedure: The test takes around 10-15 minutes to complete.

4. Reduced anxiety: The non-invasive nature of the test can reduce anxiety and stress associated with traditional diagnostic methods.

Diagnostic Advantages

1. Improved accuracy: The Cytosponge test can detect Barrett's esophagus and esophageal cancer with high accuracy.

2. Early detection: The test can identify abnormalitie 2. in the esophagus at an early stage, allowing for timely treatment.

3. Reduced need for endoscopy: The Cytosponge test can help identify patients who do not require endoscopy, reducing unnecessary procedures.

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LIMITATIONS:

While the Cytosponge test is a promising diagnostic tool for detecting Barrett's esophagus and esophageal cancer, it has some limitations:

Patient-Related Limitations

1. Gag reflex: Some patients may experience a strong gag reflex while swallowing the Cytosponge.

2. Dysphagia: Patients with difficulty swallowing (dysphagia) may find it challenging to swallow the Cytosponge.

3. Esophageal strictures: Patients with esophageal strictures or narrowings may not be able to swallow the Cytosponge.

Technical Limitations:

1. Sampling error: The Cytosponge may not collect cells from the entire esophagus, potentially leading to false-negative results.

2. Cellularity: The test requires a sufficient number of cells to be collected for accurate analysis.

3. Interobserver variability: Different interpreters may have varying opinions on the same sample, potentially leading to inconsistent results.

Clinical Limitations

1. Limited sensitivity: The Cytosponge test may not detect all cases of Barrett's esophagus or esophageal cancer.

2. False positives: The test may produce false-positive results, leading to unnecessary further testing or procedures.

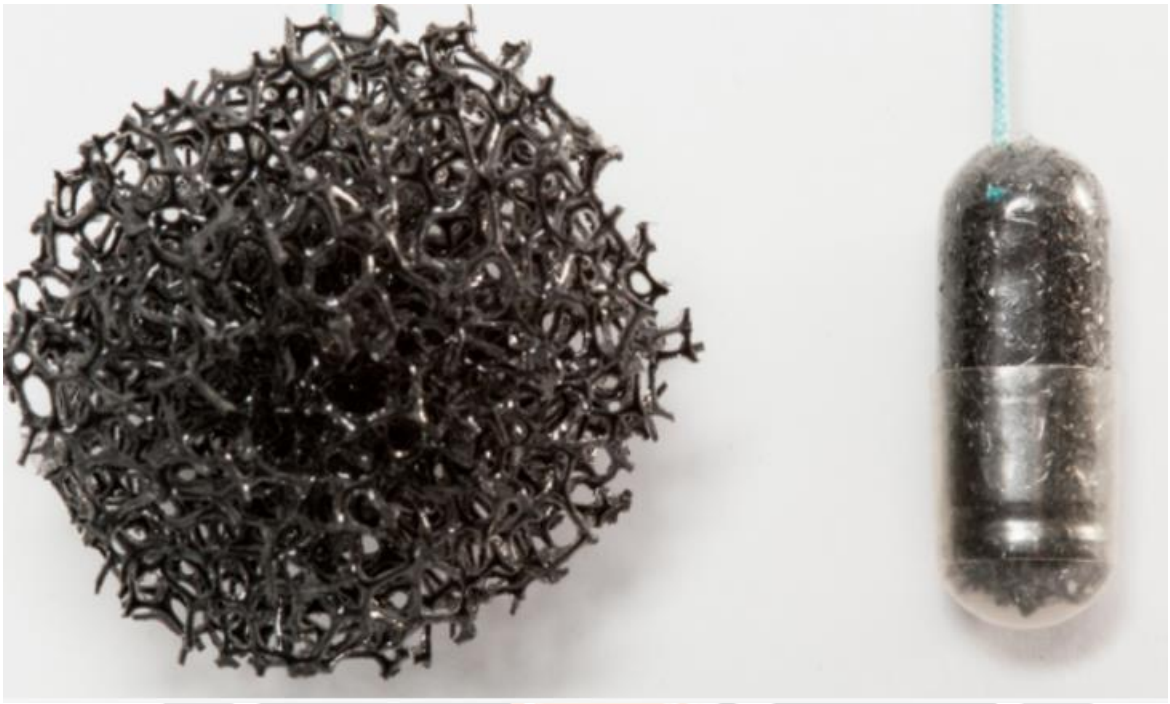
3. Lack of standardization: There is currently no standardized protocol for the Cytosponge test, which may lead to variations in results

Other Limitations

1. Availability: The Cytosponge test may not be widely available, limiting access to this diagnostic tool.

2. Cost: The test may be more expensive than traditional diagnostic methods, making it less 2. accessible to some patients.

3. Regulatory approval: The Cytosponge test may not have received regulatory approval in all countries or regions.



CONCLUSION:

Cytosponge is an easy and safe method for detecting barrets disease in cytologic specimens like TTF3 and FFPE and mucosal inflammation and decreasded microbial diversity and decreased microbial diversity both occur in EOE because of the involvement of eosinophil- derived protiens. Precancerous changes in the stomach mucosa, helicobater, and patients with reflux symptoms of barrets oesophagus examined without the use of endoscopic procedures. Cytosponge with artificial intelligence has the potential to reduce the workload of some pathologists are capable of identifying 99% of cases. Finally we coclude that for the detection of precancerous changes in the humen beings cytosponge is the most effective tool.

REFERENCES:

1 Cancer Research UK. Oesophageal cancer statistics. Available: https://www.cancerresearchuk.org/health-professional/cancer- statistics/statistics-by-cancer-type/oesophageal-cancer [Accessed 30th Dec 2020].

2 Cancer Research UK. Barrett’s oesophagus. Available: https://www. cancerresearchuk.org/about-cancer/other-conditions/barretts- oesophagus/about-barrett%27s [Accessed 30th Dec 2020].

3 Nowicki- Osuch K, Zhuang L, Jammula S, et al. Molecular phenotyping reveals the identity of Barrett's esophagus and its malignant transition. Science 2021;373:760–7.

4 Fitzgerald RC, di Pietro M, Ragunath K, et al. British Society of gastroenterology guidelines on the diagnosis and management of Barrett's oesophagus. Gut 2014;63:7–42. 11 http://bmjopen.bmj.com/ on November 22, 2024 by guest. Protected by copyright. Maroni R, et al. BMJ Open 2022;12:e054258. doi:10.1136/bmjopen-2021-054258 BMJ Open: first published as 10.1136/bmjopen-2021-054258 on 7 April 2022. Downloaded from Open access

5 Shaheen NJ, Falk GW, Iyer PG, et al. Acg clinical guideline: diagnosis and management of Barrett's esophagus. Am J Gastroenterol

6. W Januszewics, RC Fitzgerald. Early detection and therapeutics. Mol. Oncol. 2019 Mar;13(3):599-613 414

7. World Journal of Biology Pharmacy and Health Sciences, 2022, 12(03), 408–416 M O’Donovan, RC Fitzgerald.

Screening for Barrett's Esophagus: Are New High-Volume Methods Feasible? Dig. Dis. Sci. 2018 Aug;63(8):2105-2114

8. J Offman, RC Fitzgerald. Alternatives to Traditional Per-Oral Endoscopy for Screening. Gastrointest. Endosc. Clin. N. Am. 2017 Jul; 27(3):379-396.

9. Sahun WOOLLER .NHS hospital becomes the first in the world to use a 'sponge on a string' to detect oesophageal cancer in a Covid-safe way. Daily mail ; March 2021. Available at https://www.dailymail.co.uk/health/article 9373475/Hospital-world-use-sponge-string-detect-oesophageal-cancer.

10.Jones R, Coyne K, Wiklund I. The gastro- oesophageal reflux disease impact scale: a patient management tool for primary care. Aliment Pharmacol Ther 2007;25:1451–9.

11. Marteau TM, Bekker H. The development of a six- item short- form of the state scale of the Spielberger State-Trait anxiety inventory (STAI). Br J Clin Psychol 1992;31:301–6.

12.Lerman C, Trock B, Rimer BK, et al. Psychological side effects of breast cancer screening. Health Psychol 1991;10:259–67.

13. Schoen RE, Weissfeld JL, Bowen NJ, et al. Patient satisfaction with screening flexible sigmoidoscopy. Arch Intern Med 2000;160:1790–6. 14. Balsamo M, Cataldi F, Carlucci L, et al. Assessment of anxiety in older adults: a review of self- report measures. Clin Interv Aging 2018;13:573–93.

15. StataCorp LLC. Stata Statistical Software: Release 15 [program]. College Station, TX.

16 Ritchie J, Lewis C, McNaughton Nicholls C. Qualitative research practice. Second Edition. London, UK: SAGE Publications Ltd, 2014. 17 Sekhon M, Cartwright M, Francis JJ. Acceptability of healthcare interventions: an overview of reviews and development of a theoretical framework. BMC Health Serv Res 2017;17:88.

18 McBride E, Tatar O, Rosberger Z, et al. Emotional response to testing positive for human papillomavirus at cervical cancer screening: a mixed method systematic review with meta- analysis. Health Psychol Rev 2021;15:395–429.

19 Fagerlin A, Zikmund- Fisher BJ, Ubel PA. Helping patients decide: ten steps to better risk communication. J Natl Cancer Inst 2011;103:1436–43.

20 Katzka DA, Geno DM, Ravi A, et al. Accuracy, safety, and tolerability of tissue collection by Cytosponge vs endoscopy for evaluation of eosinophilic esophagitis. Clin Gastroenterol Hepatol 2015;13:77–83.

21 Freeman M, Offman J, Walter FM, et al. Acceptability of the Cytosponge procedure for detecting Barrett's oesophagus: a qualitative study. BMJ Open 2017;7:e013901.

22 Whelehan P, Evans A, Wells M, et al. The effect of mammography pain on repeat participation in breast cancer screening: a systematic review. Breast 2013;22:389–94.

23 Waller J, Bartoszek M, Marlow L, et al. Barriers to cervical cancer screening attendance in England: a population- based survey. J Med Screen 2009;16:199–204

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