

Enhancing Diagnostic Accuracy in Body Packing Cases: The Impact of Preliminary Diagnosis Awareness on Computed Tomography Evaluation

Hakan Gokalp Tas^{1*}, Turkhun Cetin², Bunyamin Ece³, Ozlem Celik Aydin⁴, Sonay Aydin²

¹Department of Anesthesiology and Reanimation, Faculty of Medicine, Erzincan Binali Yıldırım University, Erzincan, Türkiye.

²Department of Radiology, Faculty of Medicine, Erzincan Binali Yıldırım University, Erzincan, Türkiye.

³Department of Radiology, Faculty of Medicine, Kastamonu University, Kastamonu, Türkiye

⁴Department of Pharmacology, Faculty of Medicine, Erzincan Binali Yıldırım University, Erzincan, Türkiye.

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*Corresponding Author

Hakan Gokalp Tas

Department of Anesthesiology and Reanimation

Faculty of Medicine

Erzincan Binali Yıldırım University

Erzincan, Türkiye

Phone: +90 5412736633

E-mail: hakangokalptas@hotmail.com

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Authors' ORCID's

Hakan Gokalp Tas

<https://orcid.org/0000-0001-5680-9544>

Turkhun Cetin

<https://orcid.org/0000-0003-0209-4218>

Bunyamin Ece

<https://orcid.org/0000-0001-6288-8410>

Ozlem Celik Aydin

<https://orcid.org/0000-0002-8287-7126>

Sonay Aydin

<https://orcid.org/0000-0002-3812-6333>



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Abstract: Body packing refers to the concealment of illegal substances within the body. This study aims to evaluate the computed tomography (CT) findings of body packing cases, and to assess whether considering the possibility of body packing in preliminary diagnosis will affect the accuracy of specialists evaluating in the emergency and intensive care departments. 20 body packing cases were retrospectively examined for the presence of foreign bodies. A control group was created from 20 non-contrast abdominal CT images. Re-evaluation involved four radiologists. Before evaluating, two radiologists were advised they could be body packers. In 18 (90%) of 20 body packers, foreign bodies were visible in the intestinal lumen, mostly 14 (70%) in the colon. Radiologists who were given preliminary diagnosis, correctly identified all 18 (100%) intestinal foreign body cases and did not make any false positives. Two other radiologists correctly identified 16 (88.9%) cases and missed 2 (11.1%) cases and there was significantly difference ($p < 0.001$). In conclusion, packaged foreign bodies being observed most commonly in colonic segments. Evaluating without knowledge of the preliminary diagnosis of body packing significantly reduces the diagnostic accuracy. Keeping body packing cases in mind in emergency and intensive care departments in centers where they may be more prevalent can increase the diagnostic rate. When a tentative diagnosis is known, there is a greater chance of finding foreign bodies on CT scans, which increases diagnostic accuracy. This is especially true in high-prevalence settings where emergency and intensive care units may experience body packing. ©2024 NTMS.

Keywords: Body Packing; Computed Tomography; Pre-Diagnosis; Foreign Bodies/Diagnosis; Drug Trafficking.

1. Introduction

Body packing refers to the concealment of illegal substances, such as drugs, within the body, primarily within the gastrointestinal tract. The phenomenon of body packing was initially documented in the scientific literature in 1973 by Deitel and Syed¹. In their study, they detailed a case involving a 21-year-old individual

who experienced a partial blockage of the small intestine because of ingesting a condom stuffed with hashish. The practice of body packing has been acknowledged as a means of illicit drug transportation for a period exceeding four decades. The recent rapid growth in global travel and trade further complicates

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the challenges law enforcement faces in intercepting these substances.

Body packers utilize a deliberate method wherein pharmaceuticals are either ingested or concealed within bodily cavities such as the vagina, stomach, and ears. Body packers possess the capability to transport an approximate quantity of 1 kg of illicit substances, typically distributed across many packages. The packets are enclosed utilizing a diverse range of materials and forms, such as condoms, plastic bags, capsules, latex gloves, or balloons^{2,3}. The packets commonly include of many narcotics, including heroin, cocaine, opium, cannabis, amphetamines, 3,4-methylenedioxymethamphetamine (commonly known as 'ecstasy'), marijuana, and derivatives of methamphetamine. Heroin is widely recognized for its potency, being nearly twice as strong as morphine. Body packers are colloquially known as "mules", "internal carriers", "swallowers", "couriers" and have increasingly resorted to ingesting or inserting packets of illicit substances in an attempt to evade detection at international borders³⁻⁵.

The most notable medical concerns associated with body packing typically manifest as indications and manifestations of drug toxicity resulting from the leakage or rupture of packets, as well as symptoms arising from the ingestion of comparatively sizable foreign objects, such as gastrointestinal blockage or perforations⁶. There has been an observed increase in the admission of bodypackers to the surgical department⁷. However, a majority of the patients have the potential to get conservative treatment⁸. Several factors have been identified as potential predictors for the necessity of surgical intervention. These factors include a history of abdominal conditions, presence of pain, occurrence of high blockage, and detection of cocaine in the urine^{9,10}.

The practice of body packing has gained global recognition, as evidenced by the publication of case reports in many regions including the United States, Europe, Asia, and Africa. During the period from 1993 to 2005, a total of 1250 individuals engaged in body packing were apprehended at John F Kennedy International Airport in New York¹¹. However, following the terrorist attacks that occurred on September 11, 2001, there was a notable 60 percent rise in the number of arrests related to body packing^{4,12,13}. The exact cause of this increase remains uncertain, as it could be attributed to heightened trafficking activities, enhanced surveillance measures, or a combination of both factors³. Between the years 1990 and 2001, a significant number of fatalities, around 50, occurred in the greater New York City region due to the clandestine concealment of illicit substances. The majority of these deaths were attributed to acute toxicity resulting from drug usage¹⁴. While initial studies indicated that a significant number of patients experienced drug toxicity due to inadequate packaging of medications, recent data indicates that instances of leakage are infrequent and the majority of patients can be

effectively treated with conservative management strategies^{8,15}.

Historically, the detection of body packing relied heavily on non-specific clinical symptoms, physical examinations, and conventional radiography (X-ray)¹⁶. However, these methods have their limitations, notably the reduced sensitivity and specificity in detecting foreign bodies, especially when the packets are well concealed. The diagnostic approach to suspected cases of body packing has undergone a major paradigm shift since the introduction and widespread use of CT scanning. Abdominal CT, in particular, has emerged as a leading imaging modality due to its high resolution and ability to generate detailed cross-sectional images of the abdominal and pelvic areas, making it highly efficient in detecting concealed illicit packets¹⁷. Multiple studies have underscored the superiority of abdominal CT over traditional radiography in the identification and localization of ingested packets^{16,18}. The ability of CT scanning to provide multiplanar reconstructions, detailed tissue contrast, and precise packet localization is unparalleled¹⁹. These properties not only enhance the detection rates but also guide medical interventions, especially in cases where packet rupture or obstruction is a concern.

Another compelling advantage of CT over conventional X-ray is its ability to differentiate between organic and inorganic materials. This is particularly significant as body packers often use varying materials, from latex to plastic and even animal intestines, to wrap drugs²⁰. A study by Pache et al. emphasized that abdominal CT can reliably differentiate between the various packaging materials, therefore offering a decisive tool in confirming or excluding the diagnosis²¹. However, it's essential to note the ethical concerns associated with the use of CT scanning. While it presents unparalleled advantages, there is a need for discretion in its use, especially given the radiation doses involved. Guidelines and criteria must be established to ensure that CT scans are reserved for high-suspicion cases, ensuring the optimal balance between effective detection and patient safety. Although the superiority of abdominal CT over X-Ray is known, in some cases it may be difficult to distinguish a foreign body in the digestive tract from normal intestinal content^{22,23}.

The aim of this study is to retrospectively evaluate the abdominal CT findings of body packing cases detected at our center. This study also aims to determine whether the accuracy of experts reviewing imaging in emergency and intensive care units would be impacted by taking into account the likelihood of body packing, particularly in colon computed tomography images, in the early diagnosis.

2. Material and Methods

Ethics committee approval was obtained from the local ethics committee for this retrospective study (ethics committee no: E- 008127893.08/01-23). The study was conducted in accordance with the Declaration of

Helsinki. Due to the retrospective design of the study, obtaining informed consent was not deemed necessary by the ethics committee.

In 2022, an operation conducted by law enforcement authorities resulted in the capture of 20 foreign nationals. Abdominal CT scans were taken in our hospital to examine the captured couriers.

Images of these 20 individuals were retrospectively examined from the hospital information management system. The presence of objects that could belong to an opaque or non-opaque foreign body within the digestive tract was assessed. The localization of foreign body detection was recorded (Figure 1). The patients were followed by law enforcement officers and definitive findings were obtained regarding illegal substances in their stools. The definitive diagnosis of body packers was obtained by stool examination.

A control group was randomly formed by obtaining 20 non-contrast abdominal CT images from a similar age group, previously taken with the same CT device. While forming the control group, patients who had undergone any intestinal surgery, had any acute intestinal pathology such as ileus, perforation, volvulus, patients with firearm injuries, or penetrating abdominal injuries were excluded, and patients without intestinal pathology were included in the study.

As a result, a total of 40 non-contrast abdominal CT images were obtained, consisting of 20 body packer cases and 20 control cases. Four radiologists with years of experience, respectively 13 years, 10 years, 9 years, and 8 years, were consulted for re-evaluation. Before evaluating the 40 CT images, two radiologists with 13 and 8 years of experience were informed that these abdominal CTs taken in the emergency and intensive care departments could potentially have a preliminary diagnosis of body packers, while the other two radiologists were asked to evaluate the abdominal CT images taken in the departments without any preliminary diagnosis. Thus, two evaluation groups were formed, one with knowledge of the body packing preliminary diagnosis and one without. Each radiologist was instructed to record any positive findings.

All non-contrast abdominal CT scans were obtained using a 16-section multi-detector computed tomography machine (Siemens Somatom, Forchheim, Germany). The following technical specifications were used in the CT machine: pitch was 0.8, rotation time was 0.6 seconds, slice thickness was 1.5 mm, tube voltage was 130 kVp, automatic tube current modulation was 70 mAs.

2.1. Statistical Analysis

To summarize the data collected in the study, descriptive analyses were performed. For categorical variables, frequency tables were utilized to present the distribution of the various categories, whereas for continuous variables, such as age, the mean, standard deviation (SD), minimum (min) and maximum (max) values observed were calculated. Chi-square test was

used for comparisons between groups of radiologists who were aware of the pre-diagnosis of body packing and those who were not. The interobserver variation among the first and second group of radiologists were assessed by the kappa statistic. Observer agreement was categorized by kappa values as poor (<0.20), fair (0.20-0.39), moderate (0.40-0.59), good (0.60-0.79), or excellent (>0.80)²⁴. $p < 0.05$ was considered statistically significant.

3. Results

The average age of the 20 individuals included in the study group of body packers (14 male, 6 female) was 34.3 ± 5.8 years (Table 1), while the average age of the 20 normal control group individuals (14 male, 6 female) was 36.1 ± 5.3 years.

In the study group consisting of 20 body packer cases, foreign bodies were visible in the intestinal lumen in 18 (90%) of the patients, while in 2 cases, there was evidence of disappearance and dispersion of foreign substances within the lumen. Defined foreign bodies were observed in the gastric lumen in 2 (10%) individuals and in the duodenojejunal junction in 2 (10%) individuals. In the remaining 14 (70%) individuals, foreign bodies were observed at various levels within the colonic lumen (Table 1). None of the patients in the control group had intestinal foreign bodies.

Table 1: The regions and proportions of the body packing individuals where the foreign substance was detected by abdominal computed tomography.

Age, years (Mean \pm SD)	34.3 \pm 5.8	
Gender (Female/Male)	6/14	
Foreign body localization	n	%
Gastric lumen	2	10
Duodenojejunal junction	2	10
Colon	14	70
Disappear in the intestinal lumen	2	10
Total	20	100

In all 18 (100%) cases where intestinal foreign bodies were visible, the two radiologists who were initially given the preliminary diagnosis of body packing correctly identified the patients, and none of the 20 patients in the control group had any false positive diagnoses of intestinal foreign bodies.

The two radiologists who were not given the preliminary diagnosis of body packing correctly identified 16 (88.9%) of the 18 cases in which intestinal foreign bodies were visible, while they missed 2 cases. In both cases, the foreign bodies had a non-opaque appearance. They did not make any false positive diagnoses of intestinal foreign bodies in any of the 20 patients in the control group.

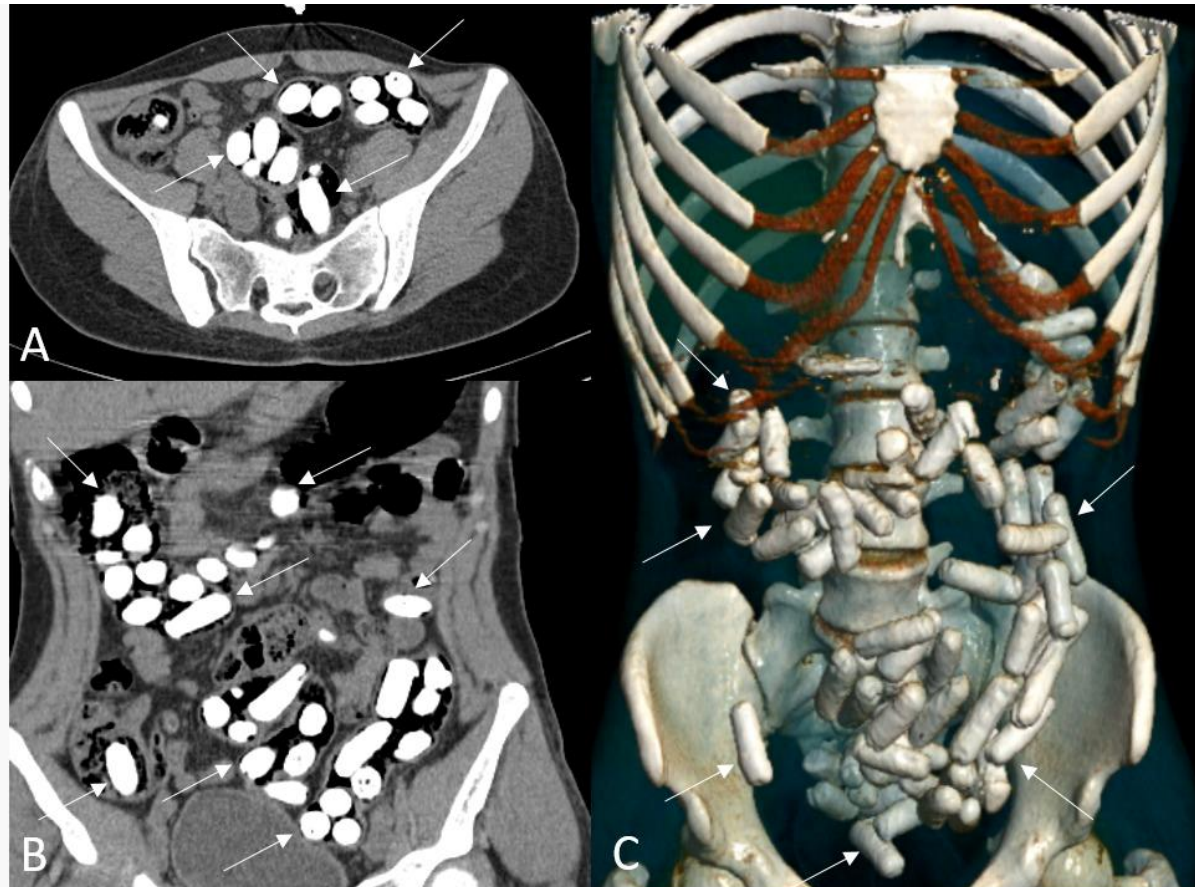


Figure 1: A 23-year-old female body packing case. A) Axial non-contrast abdominal computed tomography (CT) image shows multiple opaque foreign bodies (arrows) within the colon segments. B) Multiple opaque foreign bodies (arrows) are seen in all colon segments in coronal cross-sectional images. C) Opaque foreign bodies in the colon segments are seen on 3D reconstructive CT images (arrows).

There was excellent agreement between the two groups of radiologists with a kappa value of 0.898. However, the rate of correct diagnosis in the group given the preliminary diagnosis of body packing was statistically significantly higher than in the group not given the preliminary diagnosis ($p < 0.001$).

4. Discussion

In our study, we retrospectively evaluated the CT findings of body packing cases in intensive care unit. We also created a control group without body packing and compared the diagnostic results of two different groups of radiologists, those who knew the preliminary diagnosis of body packing and those who did not. One of the most important results of our study is that it is shown that keeping the preliminary diagnosis of body packing in mind is diagnostically important. The surreptitious smuggling of illicit drugs in the body is an ongoing global challenge. These "mules", as they are colloquially known, often risk their health for the purpose of drug trafficking, putting themselves in danger of serious complications such as bowel obstruction or drug toxicity from packet rupture³. With the stakes so high, both from a medical and legal standpoint, accurate and swift identification of these

internalized drug packets is of paramount importance. It is important for the person evaluating radiological images to have information about the patient's clinical history and existing preliminary diagnoses. In our study, radiologists who were aware of the preliminary diagnosis of body packing made accurate diagnoses with a high degree of accuracy, while the group of radiologists who evaluated without a preliminary diagnosis achieved a statistically lower accuracy rate in detecting foreign bodies. These results highlight the importance of having a preliminary diagnosis.

Law enforcement officers often detect the use of body packers and thereafter refer them to therapists for assessment, treatment, and retrieval of the concealed packets. Nevertheless, a considerable proportion of patients seek medical attention due to symptoms that are either associated with intestinal obstruction or drug toxicity. Both complications have the potential to result in fatality if the underlying disease is not identified by clinical means. None of the body packing cases in our study required surgical treatment. Foreign bodies were removed with conservative treatment and follow-up.

Despite the tendency of body packers to provide misleading information in order to evade legal consequences, it is crucial to gather a comprehensive

and precise medical history. This should encompass the specific drug being transported, the nature of the packaging material (with homemade or improvised wrapping posing a higher risk of leakage or rupture), the quantity of ingested packets, and any gastrointestinal symptoms such as pain, distention, or obstipation that may indicate obstruction or perforation. Additionally, it is important to inquire about the individual's personal use of illicit substances, as this information aids in the interpretation of toxicology testing, as well as their use of pharmaceuticals that affect gastrointestinal motility, either promoting or inhibiting it. There is a prevailing belief that the majority of those involved in body packing has precise knowledge regarding the quantity and composition of their packages, as they are obligated to provide a specified amount upon reaching their destination²⁵. In our study, the 20 individuals with body packing cases were brought in for forensic examination, so there were no diagnostic challenges. However, in areas where such illegal drug trafficking is common, one of the important points emphasized by our study is the need to consider the diagnosis of body packing cases to avoid overlooking them.

The indication of a "toxic syndrome" or "toxidrome" (a collection of bodily manifestations indicating toxicity resulting from a certain medicine) implies the release of drug substance from its packaging. The opioid toxic syndrome, as observed in cases involving heroin, is characterized by symptoms including a diminished mental state, reduced respiratory function, constricted pupils, and impaired gastrointestinal motility²⁶. The sympathomimetic toxic syndrome, which arises from the use of cocaine or amphetamine/amphetamine analogues, encompasses symptoms such as agitation, hypertension, tachycardia, mydriatic pupils, and diaphoresis. The presence of a significant accumulation of cocaine or amphetamine in the large intestine of a patient poses a serious risk to their life and necessitates prompt management. Due to the infrequency of trafficking including other medications such as cannabis and synthetic cannabinoid receptor agonists, it is advisable to approach patient management on a case-by-case basis. In terms of general guidelines, it is advisable to adopt a similar approach in managing patients who have swallowed substances with recognized life-threatening toxicity, such as those associated with cocaine, as well as those who have ingested medicines with similar characteristics to opioids²⁷.

The determination of body packing diagnosis is established using a combination of a suggestive medical history, observations made during physical examination, and the utilization of diagnostic imaging, typically involving a plain radiograph of the abdomen. For many years, the method of choice for finding these hidden packets was traditional radiography. However, because of its intrinsic benefits, abdominal computed tomography (CT) has progressively become the most widely used imaging modality in this field²⁸.

Traditional radiography's decreased sensitivity and specificity is one of its main drawbacks. When radiography packets are constructed of low-density materials or are positioned in a way that causes them to overlap with bones or excrement, they might cause equivocal results that can be misinterpreted²⁹.

On the other hand, CT's ability to provide high-resolution cross-sectional images gives it a clear edge. A study by Bulakci et al. found that abdominal CT has a sensitivity and specificity of close to 100% in detecting internalized drug packets, making it an almost foolproof technique¹⁶. The detailed contrast provided by CT allows for distinguishing drug packets from other abdominal contents with great precision.

Another significant advantage of CT scans is their ability to differentiate between organic and inorganic materials. As body packers use a myriad of materials to wrap drugs, ranging from latex and plastic to animal intestines, this ability is crucial²⁸. With the modernization of drug trafficking techniques, traffickers are continuously innovating in packaging materials to evade detection, making the CT scan's capability even more vital. Apart from detection, CT scans provide accurate localization of the packets, which is essential for medical management. In cases where there's a concern about packet rupture or obstruction, CT imaging can guide interventions such as endoscopy or surgery²⁹. Precise localization is also pivotal for forensic investigations, helping ascertain the quantity and positioning of the concealed drugs.

Despite its advantages, the use of CT scanning isn't without its controversies. Given the radiation doses involved, there's a need for discretion in its use. There is also an ethical concern regarding the involuntary examination of suspected individuals without their consent²⁹. Thus, it is imperative to have clear guidelines and criteria ensuring that CT scans are reserved for high-suspicion cases, balancing effective detection and ethical considerations.

Another discussion point revolves around the cost. CT scans are notably more expensive than traditional X-rays. While they offer unparalleled precision, the economic implications, especially in lower-resource settings, cannot be ignored. However, one could argue that the costs associated with medical complications (should a packet rupture or cause obstruction) or legal implications (if drug packets go undetected) might outweigh the initial cost of the CT scan³⁰.

With the continuous advancement in imaging technologies, the future might bring even more efficient and safer methods for the detection of body packing. Innovations such as lower radiation dose CT protocols or the use of MRI, which does not involve ionizing radiation, might offer promising alternatives³¹.

5. Conclusion

In conclusion, in body packing cases, packaged foreign bodies being observed most commonly in colonic segments, as well as in intestinal segments such as the stomach and duodenum on CT. Evaluating without

knowledge of the preliminary diagnosis of body packing significantly reduces the diagnostic accuracy. Keeping body packing cases in mind in emergency and intensive care departments in centers where they may be more prevalent can increase the diagnostic rate. As the battle against drug trafficking continues, the medical community, in collaboration with law enforcement, will continue to rely heavily on advanced imaging techniques to protect individual and public health.

Limitations of the Study

There are some limitations to the study. The most significant limitation is that all body packing cases were apprehended by law enforcement authorities in a single event. This may suggest that every individual used a similar or the same method, and it prevented us from assessing the radiological detectability of different methods used for packaging foreign bodies. The small number of patients and the retrospective design of the study and the bias that may be caused by the small number of patients are other limitations of the study. Additionally, the radiologists who performed the evaluation were not experts in forensic medicine. Another limitation is that, despite our efforts to exclude intestinal pathologies when selecting the control group, there is a possibility of bias in the control group selection. In addition, in daily practice, feces content can be observed in various forms, and evaluating this with a limited control group of 20 individuals is another limitation of the study.

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Conflict of Interests

The authors declare that they have no conflict of interest to disclose.

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Author Contributions

Conception, HGT, BE, OCA. and SA; Design, OCA.; Supervision, OCA. and SA; Materials SA; Data Collection and Processing, TC, BE, OCA., and SA; Analysis and Interpretation, HGT, TC and SA; Literature Review, OCA. and SA; Writing, HGT, BE, OCA., and SA; Critical Review, HGT, TC, and BE.

Ethical Approval

This study was conducted in accordance with the Declaration of Helsinki of 1975 (as revised in 2013), and the protocol was reviewed and approved by the Institutional Review Board (or Ethics Committee) of Erzincan Binali Yildirim University (Date: 13 July 2023, Ebyu-kaek-no E-1537893901-000187890124467/07-2023)

Data sharing statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Consent to participate

None.

Informed Statement

Due to the retrospective nature of the study informed consent was not required.

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