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FORENSIC RADIOLOGY SPECIAL FEATURE: REVIEW ARTICLE

Radiological and practical aspects of body packing

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ABSTRACT

Body packing represents the concealment of illegal substances in a person's body with the aim of smuggling. "Body packers" either swallow drug-filled packets or introduce drug-filled packets into their bodies rectally or vaginally with the purpose of concealing them. The three main smuggled drugs are cocaine, heroin and cannabis products. Body packing represents a serious risk of acute narcotic toxicity from drug exposure, intestinal obstruction owing to pellet impaction and bowel perforation with consequent abdominal sepsis. A suspected body packer is generally admitted to hospital to perform imaging investigations and confirm the presence of drugs in his/her body. Radiological imaging methods are essential to diagnose body packing and to detect potential complications. Increasing sophistication of traffickers and improvements in packaging add to the detection difficulty. Radiologists should be aware of the appearance of drug packets in a range of imaging modalities. This article informs physicians about the challenging aspects of body packing, its background and medicolegal issues, what imaging methods can be used and what criteria are necessary to perform a correct diagnosis.

Body packing was first reported in 1973 by Deitel and Syed,¹ who described a 21-year-old patient who had developed small bowel obstruction after swallowing a condom filled with hashish. The term "body packer" generally describes a drug courier who conceals packages containing illicit substances in the alimentary tract,^{2,3} usually by swallowing them in order to carry them commonly across international borders. A wide range of illicit drugs may be transported in this way, including cocaine, heroin, marijuana, hashish, amphetamines and "ecstasy" (methylenedioxymethamphetamine).⁴ People included in these illegal practices refer to the emergency department with multiple diagnostic, ethical and legal issues. In addition to confirming the presence of concealed drugs, the radiologist must recognize and look for the signs of complications that these drug packages can cause. These include small bowel or large bowel obstruction, gastrointestinal perforation and subsequent acute peritonitis.⁵ In addition, package rupture can cause systemic drug absorption, resulting in drug toxicity or overdose.⁶ Radiologists have a key role in the identification of ingested packages.⁵ Plain abdominal

radiography is currently used in the evaluation of patients with ingested, aspirated or introduced foreign bodies,⁷⁻⁹ or for the identification of pneumoperitoneum in patients with alimentary tract perforation.¹⁰ It is also the most widely used radiological procedure to recognize drug-filled packets between 2 and 8 cm in length within the gastrointestinal tract of body packers.^{5,11,12} Specific findings, such as the "double-condom" sign, can be indicative of drug packages but are not frequently identified on plain abdominal film.⁶ Recently, the use of CT in the evaluation of suspected body packers has become more widespread.⁴ However, there are legal restraints related to overexposure to radiation, and CT examinations are therefore generally performed in cases with negative abdominal plain films but a high index of suspicion of package concealment. The present review aims to highlight (1) salient identification criteria of a drug courier, (2) key findings in radiological imaging and (3) practical difficulties in the detection of the drug packets with different radiological investigations. Medicolegal issues related to body packing are also discussed.

DRUGS, PACKETS AND DRUG COURIERS

Usually, there are three main drugs smuggled using body packing: cocaine, heroin and cannabis products. Synthetic drugs, such as ecstasy and lysergic acid, are uncommonly detected in body packers, probably because of the lower financial incentive associated with their transport and the ease of synthesis closer to the end user. In Europe, smuggling hallucinogens such as mescaline and psilocybin (also called magic mushroom) is uncommon.⁵ Packing varies widely in form and size depending on the sophistication of the traffickers and whether these are handmade or produced mechanically. The orally ingested packets are commonly round in shape, whereas the genitally inserted packets are usually oval, measuring 4–6 cm in length and 2–3 cm in width.^{5,13}

Three different types of cocaine packets have been described by McCarron and Wood.¹⁴ Type I includes loosely packed cocaine powder protected by two to four films of condoms; such a packet is extremely vulnerable to leakage and rupture.¹⁴ Type II and Type III contain firmly packed cocaine powder or paste. The second type is strongly covered in several layers of tubular latex and generally gives the idea of having been packed directly by using a machine. The third type has a layer of aluminium foil. Moreover, the Type IV packet has been described by Pidoto *et al*.¹⁵ it is made by dissolving cocaine hydrochloride in a watery alcohol solution. The resultant dense cocaine paste is transferred into a processing apparatus and, when reinforced, is ready for

packaging in tubular latex.¹⁵ Preparation is concluded when the packet is covered with coloured paraffin or fibreglass. Each of these cocaine-filled packets contains about 1 g of cocaine powder of different purity (5–20%), generally loosely wrapped in multiple layers of packing material of varied type, including plastic wraps, plastic bags, condoms, aluminium foil, cellophane paper and glassine.¹⁶ Currently, the word “body packer” is generally used to define a drug carrier who swallows packages of illicit drugs to hide them in his/her alimentary tract. These criminals carry several names: “body packers”, “couriers”, “swallowers”, “internal carriers” or “mules”.¹⁷ Body packers commonly ingest large bags (2–8 cm)¹⁵ containing drugs prior to crossing international borders, to recover them after arrival at their destination. Their drug bags are carefully packed and enveloped in containers expected to remain undamaged during the gastrointestinal tract transit. To increase clarity, two other terms have been used: “body pusher” and “body stuffer”. The “body pusher” introduces the drug packages rectally or vaginally; these packages are commonly bigger than those swallowed.¹⁶ The “body stuffer”, also called “mini packer”, is an individual (usually a trafficker or user) who ingests small amounts of loosely wrapped narcotics, plastic pouches or small pellets upon an accidental encounter with law enforcement for fear of arrest.¹⁶ Detection of body packers depends on the clinical presentation and a suggestive history.¹⁸ Body packers generally carry about 1 kg of narcotic, separated into 50–100 packets of 8–10 g each, although the carriage of >200

Figure 1. Body packer imaged with plain films and CT. Upper (a) and lower (b) abdominal plain films showing multiple cocaine-filled packets distributed throughout the colon. A topogram (scout image) of a subsequent CT shows the same pattern (c). Oblique coronal (d) and oblique axial (e) reformations of the performed CT showing multiple packets in the colon again, with difference in density suggesting difference in purity of content. Note the lack of oral or intravenous contrast administration.

Figure 2. Plain abdominal film (a) and coronal (b), oblique (c and d) and axial (e) CT images (CT performed immediately after plain abdominal film), showing the double-condom sign as lucent rims around dense packets [white arrows in (a), black arrow in (c) and black arrows in (e)]. Also seen is the parallelism sign [black arrows in (a) and white arrows in (d)], as well as the tic-tac sign [bordered by the white box in (a)].

packets by individual traffickers has been described.⁶ The preponderance of drug couriers are young males, predominantly of coloured skin.¹⁹ According to a well-known dragnet by customs, narcotic importers involve white and European or North American drug mules.¹⁹ Once selected as a drug courier, the individual must sustain a fast training period in which he or she swallows a large number of harmless objects ranging from grapes and plums to condoms filled with powdered sugar.¹⁹ Body packers carry along with their luggage a variety of paraphernalia required to conceal and repack prematurely excreted packets.¹⁹ This usually includes condoms, latex fingers and gloves in addition to petroleum jelly or coconut oil to aid ingestion and toilet paper, sprays and deodorants to conceal malodorous flatulence and vomiting. Coal tablets may also be carried in an attempt to minimize drug absorption in case of packet rupture.⁵ During flight, the drug courier practises a rigorous diet or eats nothing to decrease intestinal peristalsis. Medication such as spasmolytics may be used to reduce peristalsis of the intestine, and this may be augmented by the use of constipating medication (such as loperamide or diphenoxylate) to maintain the rectal motility as low as possible to prevent unwanted defecation of packets until the final destination has been reached.⁵ Once the drug courier has successfully crossed the border, mild laxatives or enemas are utilized to facilitate container excretion and retrieval from faeces.

APPEARANCE OF DRUG PACKETS ON RADIOLOGICAL IMAGING

According to a multimodality diagnostic approach, the first imaging procedure should be a conventional radiograph (CR) or Lodox [low-dose linear slit digital radiography (LSDR)] if available.^{20,21} LSDR is a whole-body scanning technique used as a security detector. This device was first used to discover diamonds being smuggled out of mines and made a crossover from a diamond detector to a low-dose trauma scanner. Its lower radiation dose and high-quality images make it a good alternative to CR; however, it is limited by a slightly distorted image.²¹ Plain abdominal film is still the most utilized radiological procedure to recognize drug-filled packets of 2–8 cm within the gastrointestinal tract of body packers.^{5,11,12} Nevertheless, because of limited contrast resolution, CR has a sensitivity for detecting drug packets of only 40–90%.^{6,12,22,23} Densely packed heroin, hashish and cocaine (Figure 1) may have similar radiological appearances, being more radio-opaque than faecal balls on plain abdominal film. On the other hand, heroin packed as a powder may have a density similar to air and cocaine powder a density similar to water.⁵ On plain abdominal radiographs, the radiologist should search for the presence of the following findings (Figure 2): (a) one or multiple well-defined opacities in the stomach, small bowel or large bowel that are not suggestive of alimentary content;⁵ (b) the “double-condom sign”, defined as a clear crescent of air bordering an ovoid

Figure 3. Sagittal reformatted chest CT showing three drug packets (arrows) located in the oesophagus in a young body stuffer.

opacity;⁵ (c) a smooth and uniformly shaped oblong structure (sometimes called the “tic-tac sign”²⁴); or (d) the “parallelism sign”, defined as firm packages aligning parallel to each other in the bowel lumen.^{24,25} On plain abdominal radiographs, the common drug packet mimicks are normal intestinal air, calcifications, scybala and other foreign bodies.^{26–31} Moreover, a correct radiological diagnosis may be difficult because of many factors such as low-contrast resolution of the chosen imaging procedure, small number and low size of ingested packets, the use of enema and an inexperienced radiologist.²⁵ Radiographic evaluation after oral contrast-medium administration with hydrosoluble contrast agents has been performed for investigation of body packers. However, for identification of the small-sized cocaine-filled packets, which may be situated anywhere in the digestive tract, this diagnostic procedure does not improve sensitivity.⁵ The use of repeated plain

Figure 4. Abdominal CT scan showing a single packet (arrow) in the rectum.

radiographs may improve results, although false positives can result from constipation induced by opiate-filled packets or anti-motility drugs.¹⁸ Ultrasonography is a fast and radiation-free alternative procedure.^{32,33} It is the first choice modality in the detection of free fluid, which can indicate complications of body packing such as intestinal perforation.¹⁸ In experienced hands, sonography is a specific test;¹⁸ however, its sensitivity is low, and a negative ultrasound examination cannot exclude the presence of ingested drug packets. Packets mixed with stool and gas are often easily missed, and sensitivity is considered lower than plain radiographs.¹⁸ On ultrasound, the packs appear as oval or round, smooth-surfaced, hyperechogenic structures, with dorsal echo extinction due to absorption. Currently, the management of drug packers is moving to rely more heavily on CT examination.³⁴ Its sensitivity ranges from 95.6% to 100%.¹⁴ It is commonly used for cases with negative abdominal plain films, which remain strongly suspicious of drug packing. CT examination should be performed without oral or rectal contrast material administration, which may obscure concealed packages because of similarities in density. Moreover, contrast agents stimulate the peristalsis determining an osmotic intestinal inflow, which would be contraindicated in small bowel obstruction. Intravenous contrast agent should be administered in the presence of other clinical indications such as bowel ileus.¹⁵ Before reading the CT examination, the scout CT view (Figure 1c) should be examined,^{35,36} especially in cases

Figure 5. Female combined body packer/vaginal body stuffer. Axial (a), oblique sagittal (b) and oblique coronal reformatted CT (c). Large drug packet located in the vaginal cavity [black asterisk in (a), (b) and (c)], with the uterus marked in (b) (white asterisk). Multiple smaller drug packets located in the colon and rectum [black arrows in (a), (b) and (c)].

Figure 6. Small bowel obstruction in a body packer demonstrated on abdominal plain films (a and b) and axial reformatted CT (c). Small bowel distension seen by gas-filled small bowel loops with multiple dense cocaine-filled packets projecting over the pelvic as well as the gastric region on plain films. On CT, dense packets are clearly seen [black asterisks in (c)] with small bowel loops distended with fluid [white asterisks in (c)] and air-fluid levels [white arrows in (c)].

without a first plain radiograph. On CT examination, it is crucial to assess the entire gastrointestinal tract carefully, from the oesophagus (Figure 3) to the rectum (Figure 4). In females (Figure 5), the vaginal cavity must be evaluated for body pushing, even if this is commonly digitally examined if suspected. Detection increases by viewing at lung settings—window width 1000 HU and window level 2700 HU—in addition to the common abdominal CT settings (window width 350 HU and window level 50 HU).³⁷ As on plain abdominal film, the ingested packets appear on CT examination as round or oval dense foreign bodies located within the gastrointestinal tract, and classic appearances such as the “tic-tac sign” may be visible (Figure 2). The “rosette sign” is identified by the presence of air within the knot of the tied condom containing the drug in a manually wrapped packet: this sign is rarely observed nowadays because narcotic cartels are currently utilizing sophisticated packaging methods.¹⁷ Manipulation of CT may distinguish different types of drugs by estimating their HU. Chemical analysis of cocaine from retrieved packets demonstrated a broad range of purity percentages. Although pure cocaine shows a radiographic density of -200 HU, if mixed with other amounts of cutting agents and pressed, crack cocaine and cocaine powder are described to have a high density, such as 300 HU.²¹ A study demonstrated that hashish shows a density similar to bone (700 HU), cocaine is less dense than fat (-219 HU) and heroin is between the density of fat and air (-520 HU).³⁸ Another study revealed that CT attenuation values measured at low tube voltage and using the dual energy index improve the differentiation of cocaine- and heroin-containing body packs compared with measurements at higher tube voltage settings.³⁹ CT is crucial for the diagnosis of any associated complications, such as small bowel obstruction (Figure 6) or perforation (Figure 7)^{40,41} but is not appropriate as a screening procedure because of the excessive ionizing radiation burden (radiation exposure of up to 10 mSv).^{42,43} In fact, in spite of its high diagnostic performance in discovering, localizing and characterizing foreign bodies, in most European countries, the use of CT is still limited as the first diagnostic test by legislation limiting the permitted radiation dose to which an individual may be exposed for non-medical purposes, the exceptions being Hungary and Sweden, where CT is utilized as the initial diagnostic procedure.⁴⁴ Moreover, the costs of CT also have a role and are supposed to be higher for the initial diagnostic evaluation of a suspected body packer in comparison with those of plain

abdominal film.⁴⁴ Table 1 summarises the typical features of drug packets on plain abdominal film and CT, and major advantages and limits of both imaging procedures. Recently, Poletti et al²⁵ reported that low-dose CT may be a practical alternative to abdominal radiography and will lead to improvements in the identification of illegal intra-abdominal packets. However, even CT is not infallible, and there have been case reports of false-negative CT investigations.^{45,46} MRI is of limited value in detecting drug packets because of the lack of protons and motion artefacts caused by the bowel loops. The bowel must be immobilized with spasmolytic agents prior to MR study to reduce artefacts created by peristalsis.¹⁹ Despite these limitations, MRI is beginning to be advocated as an adequate method of diagnosing body packing because of its lack of ionizing radiation exposure and the ability to obtain accurate images of the gastrointestinal tract.⁴⁷

COMPLICATIONS OF BODY PACKING

Body packing is a hazardous practice and may result in grave medical and legal consequences. Medical literature comprises different reports of mortality due to intestinal perforation or acute drug toxicity when body packers attempt to transport heroin,⁴⁸ cocaine⁴⁹ or cannabis.⁵⁰ The need for surgical intervention as a result of suspected rupture,^{51,52} gastrointestinal obstruction,^{53,54} gastrointestinal ulceration⁵⁵ and even respiratory arrest due to the aspiration of a package⁵⁶ has been reported. Sophistication of the

Figure 7. Perforation in a body packer as demonstrated by right subdiaphragmatic air on a plain film of the chest [black arrow in (a)]. Multiple packets can be seen on the plain abdominal film (b) with presence of the “tic-tac” as well as the “parallelism” signs.

Table 1. Characteristic features of drug packets, major advantages and limits of plain abdominal radiographs and CT

Imaging modality	Characteristic signs	Major advantages	Major limits
Plain abdominal radiograph	Multiplicity ¹⁷ Double-condom sign ⁵ Tic-tac sign ²⁴ Parallelism sign ²⁴	Quick and cheap procedure ⁵ Low radiation exposure ⁵	Low contrast resolution ⁵ Large number of false-positive and false-negative cases ³⁶
CT	Multiplicity ¹⁷ Double-condom sign ⁵ Tic-tac sign ¹⁷ Parallelism sign ¹⁷ Rosette sign ¹⁷	The most sensitive imaging modality ⁴¹	Legal restraints to the radiation dose ⁵

packaging methods used by drug smuggling organizations has reduced the morbidity of their “drug mules”, although packet failure still represents a real risk and may cause poisoning in the country of origin, during flight or at their destination.³⁶ The “body packer syndrome” occurs when packet rupture results in poisoning, usually after cocaine or heroin ingestion.³⁶ In the patient with “body packer syndrome” the symptoms should be promptly identifiable and point to the drug being carried. Cocaine may cause agitation, tachycardia, hypertension, sweating, dilated pupils and hyperthermia. More serious effects are status epilepticus, seizures, myocardial infarction and ventricular fibrillation. Heroin may produce a decreased level of consciousness, respiratory depression and pinpoint pupils.³⁶ Rupture or leakage may occur either by mechanical movement or by chemical digestion. Acid in the stomach may invade the packs, liquefy the cocaine powder and disintegrate the pellets from the inside, and the drug may diffuse as leakage. Rupture of packages seems to happen when the packages are still located in the stomach, with the pylorus being an obstacle for large foreign bodies. Body stuffers are more likely to manifest symptoms of intoxication than body packers because of the relatively poor quality of the packaging material used.

PRACTICAL ASPECTS AND MEDICOLEGAL ISSUES

Recently, body stuffing has become more common because of increasing success rates as a result of greater sophistication of

packaging methods and smaller package size making radiological detection more difficult. Drug traffickers are continually changing the appearance and composition of the drug packets to reduce the probability of rupture and detection. Criminal gangs also select mules who they feel will arouse the least suspicion at international borders and have been known to use children to transport drugs.^{57,58} There is also a report of a pregnant cocaine body packer who required a perimortem Caesarean section after a cocaine packet rupture.⁵⁹ Radiologists working in hospitals near international airports will get good experience in detecting suspected drugs.³¹ For a radiologist, it is important to know how drug containers appear, which is best understood in the context of existing package types and manufacturing methods. Of course, identification of the packs varies widely depending on the experience of the radiologist and his/her knowledge of the appearance of incorporated drugs. Before examining a person presented by a customs inspector, radiologists should be familiar with the medicolegal situation in their country relating to the use of radiography, CT or MRI without a medical indication. This may differ across the European Community. In some countries, informed consent must be obtained prior to undergoing the test. Elsewhere in Europe, consent is not required, and the imaging investigations may be conducted at the request of a customs officer and/or following a judicial injunction.⁵ The radiologist should be aware of the patient's history and should determine when packages have been ingested, if witnessed, as well as the presence of pain or prolonged constipation, which may indicate evolving obstruction.¹⁹ Knowledge of the time of ingestion is useful to predict the anatomical location of drug packets and determine where the examination should focus. Often, however, obtaining a reliable history is difficult as language barriers and the fear of prosecution prevent the suspect from providing reliable information.

Drug mules, when under investigation, are often aware of strategies to prevent the radiologist obtaining good diagnostic images on CT. Usually, the drug carrier cooperates and consents to the radiological procedure, but then degrades the CT scan image quality by becoming agitated, moving in the scanner and beginning rapid respiration.¹⁹

False-negative reports result in the release of the suspect and the successful delivery of their payload, which will inevitably be sold on the black market. Also of concern are false-positive reports, which result in the deprivation of liberty of the accused posing

Figure 8. Multiple drug packets evacuated from a body packer.

a significant ethical problem.⁶⁰ In addition, unnecessary detention results in substantial extra costs to the authorities and embarrassment to the on-call hospital interpreting the images. Apart from forensic motives, the medical indications for radiological imaging remain of the utmost importance. Early identification of the body packer is crucial in cases of suspected intoxication either by leakage or by rupture of a drug container.⁶¹ Radiological assessment may be augmented with various other methods, including urinary morphine testing and defecation of other intact packets (Figure 8).^{62,63} Radiological assessment is required to ascertain the number of packets being trafficked to ensure that none remain prior to the release of the suspect to the legal authorities. The correct location of the drug packets is also crucial for the surgical management of body packers with drug toxicity, obstruction or perforation.

SUMMARY

Body packing, pushing and stuffing are methods by which illicit drugs may be carried within the human body.

Emergency departments face an increasing number of drug-related health problems, with difficult medicolegal and social consequences. An awareness of drug packing should therefore be promoted among medical and radiology staff.

There is a great need for the correct identification of suspected drugs in the alimentary tract by radiologists. Among the imaging modalities, plain abdominal film is the most commonly used initial imaging procedure to detect body packing. However, improvements in packaging and increasing sophistication of traffickers add to the interpretation difficulty. Physicians should be aware of the possibility of false-negative and false-positive radiographic results in the diagnosis of drug packets. As a negative plain abdominal film does not rule out body packing, a non-contrast abdominopelvic CT scan must be performed to confirm the diagnosis. CT is also useful in identifying possible complications that may arise in body packers. Low-dose CT, with a radiation burden close to that of plain film imaging, is now coming to the fore in the detection of ingested drug packets.

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