

· 论著 ·

**本文亮点:**

- (1) 比较了体内液态塑料和液态金属异物烧冲复合伤患者的临床表现、诊断和治疗的异同。
- (2) 探讨了体内液态塑料和液态金属异物烧冲复合伤的发生机制。

**Highlights:**

- (1) The clinical manifestations, diagnosis, and treatment of patients with burn-blast combined injuries caused by liquid plastic and liquid metal foreign objects in the body were compared.
- (2) The mechanism of burn-blast combined injuries caused by liquid plastic and liquid metal foreign objects in the body were explored.



# 体内液态塑料和液态金属异物烧冲复合伤患者的比较研究

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**【摘要】** **目的** 比较体内液态塑料和液态金属异物烧冲复合伤患者的临床特点、诊断方案、治疗策略等。 **方法** 本研究为回顾性队列研究。2009年1月—2019年7月康复大学青岛医院烧伤整形科收治41例符合入选标准的热溶液爆炸导致的烧冲复合伤患者。统计所有患者性别、年龄、烧伤总面积、伤后入院时间、烧冲复合伤发生部位、体内异物类型。根据体内异物类型将患者分为液态塑料组(30例)和液态金属组(11例)。统计2组患者临床特点(受伤部位肿胀情况、疼痛情况、发热情况、脓肿形成情况、损伤深度、异物活动度、异物剥离难易程度)、影像学检查(超声、计算机X线摄影、CT、磁共振成像检查)情况、治疗情况(修复时期、修复方式)、出院后随访时并发症发生情况。 **结果** 患者中男33例、女8例,年龄18~65岁,烧伤总面积为1%~78%体表总面积,伤后入院时间为2 h~7 d,烧冲复合伤主要发生在四肢及躯干,体内异物为液态塑料(聚乙烯和丙烯腈丁二烯苯乙烯)和液态金属(液态铁和铝)。液态塑料组患者受伤部位肿胀、损伤深及骨、异物活动度差、异物剥离困难的比例均明显高于液态金属组( $P<0.05$ )。液态金属组患者通过计算机X线摄影、CT检查明确体内异物的比例分别为7/7、8/8,明显高于液态塑料组的1/5、3/20( $P<0.05$ );液态金属组患者通过超声、磁共振成像检查明确体内异物的比例分别为11/11、2/2,与液态塑料组的24/26相近( $P>0.05$ )、4/4相同。液态塑料组患者行创面I期修复、直接缝合的比例明显低于液态金属组( $P<0.05$ ),行创面延期修复、皮片移植的比例明显高于液态金属组( $P<0.05$ )。2组患者并发症发生情况均无明显差异( $P>0.05$ )。 **结论** 烧冲复合伤患者因体内异物类型、存在部位不同,造成的损害严重程度也不同。计算机X线摄影和CT检查可用于诊断液态金属类异物,超声和磁共振成像检查可用于诊断体内液态塑料类异物。多学科协作与综合治疗是救治该类患者的重要手段。

**【关键词】** 烧伤; 烧冲复合伤; 液态塑料; 液态金属; 临床特征; 创面修复

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## Comparative study on patients with burn-blast combined injuries caused by liquid plastic and liquid metal foreign objects in the body

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**[ Abstract ] Objective** To compare the clinical characteristics, diagnostic plans, and treatment strategies of patients with burn-blast combined injuries caused by liquid plastic and liquid metal foreign objects in the body. **Methods** This study was a retrospective cohort study. From January 2009 to July 2019, 41 patients with burn-blast combined injuries caused by hot solution explosion who met the inclusion criteria were admitted to Department of Burns and Plastic Surgery of Qingdao Hospital of Rehabilitation University. The following indexes of all patients were collected, including gender, age, total burn area, admission time after injury, site of burn-blast combined injuries, and type of foreign objects in the body. According to the type of foreign objects in the body, the patients were divided into liquid plastic group (30 cases) and liquid metal group (11 cases). The following indexes of the two groups of patients were collected, including the clinical characteristics (swelling in the injury site pain, fever, abscess formation, depth of injury, activity of foreign objects, and difficulty in removing foreign objects), imaging examinations (ultrasound, computed radiography, computed tomography, and magnetic resonance imaging examinations), treatment (repair period and repair method), and incidence of complications during follow-up after discharge. **Results** There were 33 males and 8 females among the patients, aged 18-65 years. The total burn area was 1% to 78% total body surface area, the admission time after injury was 2 h to 7 d, the burn-blast combined injuries mainly occurred in the limbs and trunk, and the foreign objects in the body were liquid plastics (polyethylene and acrylonitrile butadiene styrene) and liquid metals (liquid iron and aluminum). The proportions with swelling in the injury site, injury with depth to the bone, poor mobility of foreign objects, and difficulty in removing foreign objects in patients in liquid plastic group was significantly higher than those in liquid metal group ( $P<0.05$ ). The proportions of confirming foreign objects in the body through computed radiography and computed tomography examinations in patients in liquid metal group were 7/7 and 8/8, respectively, which were significantly higher than 1/5 and 3/20 in liquid plastic group ( $P<0.05$ ); the proportions of confirming foreign objects through ultrasound and magnetic resonance imaging examinations in patients in liquid metal group were 11/11 and 2/2, respectively, which were similar to 24/26 ( $P>0.05$ ) and same to 4/4 in liquid plastic group. The proportions of patients in liquid plastic group who underwent stage I wound repair and direct suture were significantly lower than those in liquid metal group ( $P<0.05$ ), while the proportions of patients who underwent delayed wound repair and skin grafting were significantly higher than those in liquid metal group ( $P<0.05$ ). There were no statistically significant differences in the incidence of complications between the two groups of patients ( $P>0.05$ ). **Conclusions** Patients with burn-blast combined injuries may experience varying degrees of damage due to different types and locations of foreign objects in the body. Computed radiography and computed tomography examinations can be used to diagnose liquid metal foreign objects, while ultrasound and computed radiography examinations can be used to diagnose liquid plastic foreign objects in the body. Multidisciplinary collaboration and comprehensive treatment are important means of treating such kind of patients.

**[ Key words ]** Burns; Burn-blast combined injuries; Liquid plastics; Liquid metals; Clinical features; Wound repair

热溶液爆炸除对人体体表造成烧烫伤外,伴随高压及冲击波进入体内的异物会对人体造成二次伤害,特别是液态塑料和液态金属物质进入体内后造成的烧冲复合伤会导致重要组织器官损伤,致残率高、病情危急,若不及时、积极诊治将严重威胁患者生命,需要引起临床医师的高度重视。本研究拟分析康复大学青岛医院(以下简称本院)烧伤整形

科 10 年间收治的液态塑料和液态金属体内烧冲复合伤患者的临床资料,为临床该类患者的诊断和治疗提供参考。

### 1 对象与方法

本回顾性队列研究符合《赫尔辛基宣言》的基本原则,患者及患者家属均签署研究知情同意书。

### 1.1 入选标准

纳入标准:(1)符合烧冲复合伤所具有的烧伤和冲击伤的基本特点;(2)通过超声、CT、计算机X线摄影、磁共振成像(magnetic resonance imaging, MRI)等辅助检查明确诊断造成烧冲复合伤的体内异物为液态塑料和液态金属。排除标准:(1)临床资料缺失或不完整者;(2)随访时间<6个月者。

### 1.2 临床资料及分组与指标统计

2009年1月—2019年7月,本院烧伤整形科收治41例符合入选标准的热溶液爆炸导致的烧冲复合伤患者。统计所有患者性别、年龄、烧伤总面积、伤后入院时间、烧冲复合伤发生部位、体内异物类型。

根据体内异物类型将患者分为液态塑料组(30例)和液态金属组(11例)。观察并统计2组患者以下资料:临床特点(受伤部位肿胀情况、疼痛情况、发热情况、脓肿形成情况、损伤深度、异物活动度、异物剥离难易程度)、影像学检查(超声、计算机X线摄影、CT、MRI检查)情况、治疗情况(修复时期、修复方式)、出院后随访时并发症(出血、感染、窦道形成、瘢痕形成、慢性创面、感觉异常和功能障碍)发生情况。

### 1.3 统计学处理

应用SPSS 25.0统计软件进行数据分析。采用Shapiro-Wilk法对数据进行正态性检验,符合正态分布的计量资料数据以 $\bar{x}\pm s$ 表示。计数资料数据以频数表示,采用Fisher确切概率法检验。所有检验为双侧。以 $P<0.05$ 为差异有统计学意义。

## 2 结果

### 2.1 总体一般资料

患者中男33例、女8例;年龄18~65岁,中位年龄41.5岁,其中18~35岁者20例(48.8%)、36~59岁者16例(39.0%)、60~65岁者5例(12.2%)。38例(92.7%)患者存在多部位烧伤,烧伤总面积为1%~78%[(20±4)%]TBSA。伤后入院时间为2h~7

d,其中7例患者由外院转入。烧冲复合伤累及四肢及躯干皮下及肌肉组织者35例(85.4%)、头面部皮下者2例(4.9%)、眼部者3例(7.3%)、食道下段者1例(2.4%)。体内异物为液态塑料和液态金属,其中液态塑料为聚乙烯和丙烯腈丁二烯苯乙烯(acrylonitrile butadiene styrene, ABS),液态金属为液态铁、液态铝。

### 2.2 2组患者临床特点

液态塑料组患者受伤部位肿胀、损伤深及骨、异物活动度差、异物剥离困难的比例均明显高于液态金属组( $P<0.05$ ),见表1。

### 2.3 2组患者影像学检查情况

37例患者进行超声检查,明确体内异物者35例(94.6%);12例患者进行计算机X线摄影检查,明确体内异物者8例(66.7%);28例患者进行CT检查,明确体内异物者11例(39.3%);6例患者进行MRI检查,明确体内异物者6例(100%)。液态金属组患者通过计算机X线摄影、CT检查明确体内异物的比例分别为7/7、8/8,明显高于液态塑料组的1/5、3/20( $P$ 值分别为0.010、 $<0.001$ );液态金属组患者通过超声、MRI检查明确体内异物的比例分别为11/11、2/2,与液态塑料组的24/26相近( $P>0.999$ )、4/4相同。

### 2.4 2组患者治疗相关情况

遵循在病情稳定的前提下尽早行异物取出和创面修复的治疗原则,积极完善相关检查,根据患者病情行清创、抗休克、抗感染、抑制胃酸、碱化尿液治疗,合并吸入性损伤者行气管切开治疗,其中5例(12.2%)患者进行多学科合作治疗。创面处理措施包括清创、开放引流、筋膜室切开减压等,清除明显的坏死组织,尽可能保留间生态组织后,行创面修复。液态塑料组患者行创面I期修复、直接缝合的比例明显低于液态金属组( $P<0.05$ ),行创面延期修复、皮片移植的比例明显高于液态金属组( $P<0.05$ ),见表2。41例患者体内异物均被完全取出,创面均完全愈合并康复出院。

表1 2组体内异物烧冲复合伤患者临床表现比较(例)

Table 1 Comparison of clinical manifestations of two groups of patients with burn-blast combined injuries caused by foreign objects in the body

| 组别    | 例数 | 受伤部位肿胀 | 疼痛    | 发热    | 损伤深及骨 | 异物活动度差 | 异物剥离困难   | 脓肿形成  |
|-------|----|--------|-------|-------|-------|--------|----------|-------|
| 液态塑料组 | 30 | 25     | 27    | 20    | 24    | 25     | 25       | 7     |
| 液态金属组 | 11 | 5      | 8     | 6     | 5     | 5      | 2        | 3     |
| $P$ 值 |    | 0.041  | 0.316 | 0.491 | 0.041 | 0.041  | $<0.001$ | 1.000 |



**表 2** 2组体内异物烧冲复合伤患者的治疗时期和治疗方式比较(例)

**Table 2** Comparison of the treatment period and treatment method of two groups of patients with burn-blast combined injuries caused by foreign objects in the body

| 组别    | 例数 | 修复时期   |        | 修复方式   |        |      |
|-------|----|--------|--------|--------|--------|------|
|       |    | I期     | 延期     | 直接缝合   | 皮片移植   | 皮瓣移植 |
| 液态塑料组 | 30 | 18     | 12     | 18     | 9      | 3    |
| 液态金属组 | 11 | 9      | 2      | 9      | 2      | 0    |
| P值    |    | <0.001 | <0.001 | <0.001 | <0.001 | —    |

注：“—”表示无此项

## 2.5 并发症发生情况及预后

烧冲复合伤患者常见并发症包括感染、窦道形成、感觉异常和功能障碍,特殊的并发症包括眶内异物致眼球运动障碍、眼睑闭合不全、角膜溃疡、失明,面部异物致咀嚼功能异常,食道异物致食道溃疡穿孔、食道胸腔瘘形成、消化道出血,胸腔出血、肺不张、肺炎,手部异物致截指及手指完全性功能障碍。出院后随访6个月以上,2组患者并发症发生情况均无明显差异( $P>0.05$ ),见表3。

**表 3** 2组体内异物烧冲复合伤患者并发症发生情况比较(例)

**Table 3** Comparison of the incidence of complications in two groups of patients with burn-blast combined injuries caused by foreign objects in the body

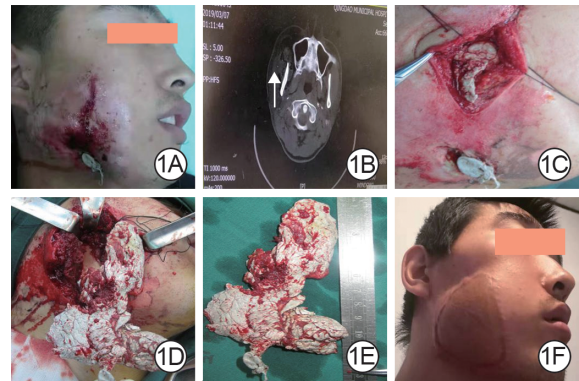
| 组别    | 例数 | 出血     | 感染     | 窦道形成   | 瘢痕形成 | 慢性创面   | 感觉异常   | 功能障碍  |
|-------|----|--------|--------|--------|------|--------|--------|-------|
| 液态塑料组 | 30 | 5      | 28     | 2      | 30   | 3      | 17     | 9     |
| 液态金属组 | 11 | 2      | 10     | 1      | 11   | 1      | 6      | 4     |
| p值    |    | >0.999 | >0.999 | >0.999 | —    | >0.999 | >0.999 | 0.719 |

注：“—”表示无此项

## 2.5 典型病例

**例 1** 男,23岁,右面颈部、左手因液态塑料(主要成分为ABS)爆炸致伤,伤后2h来院就诊。入院时专科检查见左手及右面部创面基底红白相间;右面部肿胀、疼痛明显,触之质硬,痛觉迟钝;右下颌缘处可见长约0.8cm的异物外露,异物活动度差。颅脑CT平扫示,右下颌角处皮肤破损,右面部皮肤肿胀并可见气泡征。右面部超声(探头频率11MHz)检查示,右面部皮下深0.5~1.5cm处有异物强回声,异物深及骨面,异物大小为12.0cm×7.0cm×1.5cm且边界清楚。入院诊断为:(1)面颈部、左手热塑料烫伤;(2)面部皮下异物。入院第

3天在全身麻醉下行右面部清创(清创后创面面积为12.5cm×7.5cm)、异物取出术,术中见异物与下颌支骨面贴附紧密,剥离困难。取出的塑料异物大小为14.0cm×8.0cm×1.5cm。术后患者出现发热、面部化脓感染,部分右下颌骨外露,经抗感染及创面换药。入院后15d行右股前外侧穿支皮瓣(面积为8cm×6cm)移植修复右面部创面。随访6个月,皮瓣外形、质地良好,右面部有麻木感及轻微瘢痕形成。见图1。



**图 1** 例 1 面部异物烧冲复合伤患者的检查及治疗情况。1A. 入院 2 h, 右下颌可见长约 0.8 cm 的异物外露; 1B. 颅脑 CT 平扫示右面部气泡征, 异物不显影; 1C. 入院 3 d, 行面部清创、异物取出术; 1D. 术中见右面部腮腺导管损伤, 面神经颞支、颊支、下颌缘支损伤, 笑肌、提上群肌、提口角肌、口轮匝肌、颊肌和咀嚼肌损伤; 1E. 取出的塑料异物大小为 14.0 cm×8.0 cm×1.5 cm; 1F. 随访 3 个月, 面部有色素沉着及轻微瘢痕形成。

**Figure 1** Examination and treatment in case 1 with burn-blast combined injuries caused by facial foreign objects

**例 2** 男,42岁,工作中因铝水池爆炸,高温铝水飞溅,烫伤双眼、面部、口腔、前后躯干、双上肢,疼痛明显,伤后8h入院。专科检查可见,创面位于面部、口腔、前后躯干及双上肢,双眼睑肿胀、疼痛明显,睑结膜充血,口腔黏膜损伤;面部、前后躯干及双上肢创面基底苍白、呈皮革样变,痛觉迟钝。为排除眼内及消化道内异物存留可能,行计算机X线摄影及CT检查,提示左眼内异物、消化道异物。入院诊断为:(1)全身铝水烫伤,总面积16%TBSA,其中Ⅱ度3%TBSA、Ⅲ度13%TBSA;(2)眼内异物;(3)消化道异物。入院第2天,请眼科医师会诊后行异物取出术,于左眼巩膜取出长约0.3cm金属样异物。入院4d,患者出现发热、黑便,考虑消化道出血。钡餐全消化道造影检查提示,食道下段、胃底、贲门黏膜纹粗乱、扭曲,食道右侧胸腔漏形成。多学科医师会诊后,建议转胸外科治疗。入院5d,于本院胸外科行消化道异物取出术、结肠食道

吻合手术,创面外涂磺胺嘧啶银保痂治疗。入院 40 d 转回本院烧伤整形科行面部、前后躯干、双上肢肉芽创面清创术,取头部刃厚皮片修复创面。共住院 49 d,创面完全愈合后出院。随访 6 个月时,患者消瘦,常出现腹泻现象,前后躯干和双上肢皮片移植区瘢痕增生明显、有瘙痒不适感、时有破溃,双上肢抬举困难。见图 2。

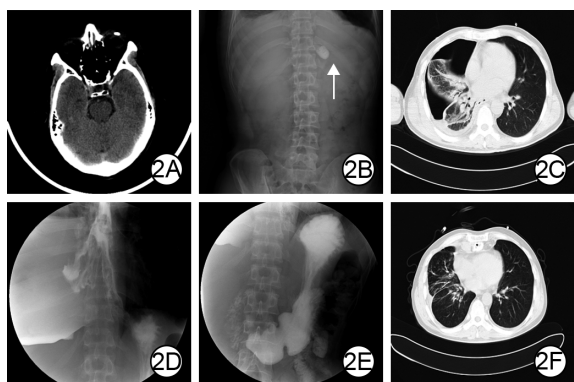


图 2 例 2 眼内异物和消化道异物烧冲复合伤患者的检查及治疗情况。2A. 入院 8 h, 颅脑 CT 检查示左眶下异物; 2B. 入院 8 h, 计算机 X 线摄影检查示食道下段异物(白色箭头); 2C. 入院 8 h, 胸部 CT 检查示右下肺不张、液气胸、右胸廓塌陷; 2D. 入院 4 d, 钡餐全消化道造影检查示食道下段、胃底、贲门黏膜纹紊乱、扭曲, 食道右侧胸腔瘘形成; 2E. 入院 5 d, 行食道异物取出, 结肠食道吻合手术后; 2F. 入院 12 d, CT 示右肺复张及条索影

Figure 2 Examination and treatment in case 2 with burn-blast combined injuries caused by intraocular and gastrointestinal foreign objects

### 3 讨论

#### 3.1 受伤人群分布特点

本研究纳入的患者中男性明显多于女性,主要集中在 18~59 岁人群。中青年,特别是男性中青年,是烧冲复合伤的高发人群,可能与他们是主要劳动力,社会活动程度高有关。该年龄段人群的安全问题应引起社会和家庭的重视,应进行严格的安全生产培训,加强安全意识,强化防护措施。

#### 3.2 临床特征和致病机制

本组病例中,爆炸所致体内异物烧冲复合伤具有致伤机制复杂、组织损伤严重、感染发生率高、创面愈合慢、容易受致伤环境及体内异物特性等多种因素影响的特点,治疗较为困难。体内异物造成的烧冲复合伤发生机制可能为:(1)异物直接损伤作用,体内异物产生的热损伤、挤压、切割、撕裂、穿透等破坏作用取决于异物携带的能量和异物的形状、结构(松散或致密),异物携带的能量与异物的质量

和速度有关;异物形状不仅影响异物在空气中飞行受到的阻力,更重要是影响创面的形状、大小以及组织吸收的能量。规则形状物质和不规则形状物质的形状系数不同,如不规则形状的物质形状系数大于圆形及圆柱形,而形状系数越大的物质,对组织造成的损伤越严重<sup>[1-5]</sup>。(2)压力波的致伤作用。爆炸可以产生数个大气压,使组织按牛顿定律向四周运动,压力波在组织中的传导造成组织损伤<sup>[6-13]</sup>。(3)瞬时空腔效应和远达效应。异物进入体内可以造成数倍于其直径、持续数毫秒、波动数次的瞬时空腔,牵拉、撕裂组织造成组织损伤;远达效应能造成远隔部位微循环障碍,导致组织缺血、坏死等<sup>[14-15]</sup>。由于烧冲复合伤患者体内异物的物理化学性质不同,临床特征也不完全相同。和金属异物相比,塑料异物患者损伤组织深度更深、肿胀发生率更高,异物与组织贴合更紧密,手术剥离异物更加困难。液态塑料类异物具有一定毒性、腐蚀性和流动性,其熔点一般在 200~300 °C,异物呈液态进入体内迅速固化,体表伤口小、体外异物暴露少、体内却为暗礁样分布,造成创面口小底大,且疼痛明显;大部分异物形状不规则,形状系数大,对组织造成机械性损伤和热损伤,异物的化学毒性及其造成的瞬时空腔效应及远达效应也可导致神经、肌肉组织的功能障碍<sup>[16-18]</sup>。液态铁、铝等液态金属类异物无毒、无腐蚀性、流动性差,其温度一般都在 600 °C 以上,进入体内形态多呈圆形或圆柱形(形状系数小),皮肤和皮下组织接触即刻就会被烧焦和碳化,造成损伤组织硬度增加。金属类异物常会进入到皮肤、皮下和肌肉组织,造成垂直损伤,但异物和组织贴合不紧密,通过手术易取出异物。本研究纳入的患者中,例 1 患者体内异物主要成分是 ABS,其是一种热可塑性聚合物,其熔点在 230~300 °C,液态时流动性好,冷却固化速度快,一般在 5~15 s 内即可冷却固化。正是因为液态塑料温度高且流动性好的特点,其造成的组织损伤均为口小底大,且异物与组织贴附紧密,难以剥离。例 2 患者在爆炸发生的即刻误吞高温铝溶液,患者只知道口腔有烫伤,但不知铝溶液被进入了食道,造成食道的严重灼伤,且并发食道胸腔穿孔,病情凶险。

#### 3.3 影像学表现

异物存留在软组织中易引起软组织感染和继发损伤,尤其是特殊部位如食道、颅脑等异物存留会导致严重的并发症,甚至危及生命,因此应尽早



取出异物。异物的定位诊断是取出体内异物、成功修复创面的前提。对于本研究纳入的病例,计算机 X 线摄影和 CT 检查均能检出体内金属异物,说明计算机 X 线摄影和 CT 为检查金属类异物的首选;但这 2 种方法检出塑料异物的比例较低。而超声和 MRI 检查对金属异物和塑料异物的检出比例均非常高,这 2 种方法对塑料的检出比例明显高于计算机 X 线摄影和 CT 检查。究其原因主要是塑料和金属密度不同,当塑料和人体组织密度可能相近时,不易被普通放射线和 CT 检查检出。随着 MRI 技术逐渐应用于临床,体内异物如玻璃、石子、布块、木屑等开始被检出<sup>[19]</sup>。由于 X 线和 CT 这些常规检查无法检出许多非金属异物,易造成漏诊误诊,因此,临床上更多依赖 MRI 检查体内非金属异物。金属类异物有磁性或少量弱磁性,在进行 MRI 检查时可发生异物移位,且金属固有的导电性能也有发生热灼伤的风险<sup>[20-21]</sup>,因此,其应用受到一定的限制。眼科及颜面外科医师已广泛采用超声对非金属异物进行诊断,有研究者认为将超声用于软组织中非金属异物的检查安全、高效、结果可靠<sup>[22-25]</sup>。例 1 患者面部异物为塑料,其密度与颜面部组织密度相当,CT 检查不显影;超声检查呈强回声,且能明确异物大小和位置,有利于后续手术取出异物。至于超声测量的异物大小与实物的误差,可能与测量部位与角度有关。总之,应根据异物类型选择合适的影像学检查技术,以提高异物取出手术的成功率。

### 3.4 治疗方法及并发症

体内烧冲复合伤患者的治疗包括全身治疗和局部治疗。全身治疗包括针对性选择抗休克、抗感染、营养支持、脏器维护及生命支持治疗等;局部治疗主要是去除异物和创面处理,可于伤后 6~8 h 病情稳定前提下进行手术,清除明显坏死组织,尽可能保留间生态组织,充分减张引流,视创面情况早期修复或延期修复创面。该类患者并发症的发生与异物的性质和伤及部位有关<sup>[26]</sup>,并发症包括出血、感染、角膜穿孔、食道穿孔、感觉异常、功能受限等,最具特征的并发症是脓肿或窦道形成。脓肿或窦道形成的机制为:液态塑料异物等因具有丰富的空隙,表面往往寄生大量的细菌,导致炎症持续存在并不断扩散,造成皮肤破溃、脓液外溢且久治不愈,最终导致窦道形成。窦道也成为高度怀疑体内异物的标志性体征。本研究纳入的体内异物烧冲

复合伤患者有脓肿或窦道形成,但通过手术治疗后,创面均完全愈合。随访观察到,2 组患者存在瘢痕、慢性创面、感觉异常、功能障碍方面的问题。

综上,体内异物烧冲复合伤病情紧急、组织损伤严重,既有皮肤的热力损伤,又有体内异物造成的机械性损伤、物理性损伤以及化学性损伤,其救治是一个复杂的过程,涉及全身多个器官、系统,并涉及多个学科<sup>[27-32]</sup>。烧伤科以创面修复见长,以烧伤科为主导的多学科协作,能明显提高该类患者的救治成功率。本研究纳入的病例数相对较少、时间跨度长、混杂因素多,且未对混杂因素进行控制,今后在临床工作中将继续收集此类病例的临床资料,进一步进行深入研究。

**利益冲突** 所有作者均声明不存在利益冲突

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