

应用 ICE 指导经皮介入封堵双孔型 房间隔缺损 1 例报道

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【摘要】 本文报道 1 例心腔内超声心动图(intracardiac echocardiography, ICE)指导下的双孔型房间隔缺损(atrial septal defect, ASD)介入封堵术。患者术前经胸超声心动图(transthoracic echocardiography, TTE)提示为双孔型 ASD(继发孔型),大小分别为 12 mm 和 13 mm,两处相距约 6 mm;在数字减影血管造影(digital subtraction angiography, DSA)及 ICE 引导下,成功应用 20 mm 小腰大边 ASD 封堵器进行封堵,术后即刻 ICE 提示房间隔无分流,封堵器位置、大小、形态良好,对周围结构无影响。

【关键词】 房间隔缺损(ASD); 双孔型; 心腔内超声心动图(ICE); 介入封堵术

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Percutaneous transcatheter closure of double-holes atrial septal defect guided by ICE: a case report

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【Abstract】 This paper reports a case of intracardiac echocardiography (ICE)-aided catheter-based closure with double-holes atrial septal defect (ASD). The patient was diagnosed as double-holes secundum ASD by transthoracic echocardiography (TTE), and the size of two holes was 12 mm and 13 mm respectively. The distance between the two holes was about 6 mm. Under the guidance of digital subtraction angiography (DSA) and ICE, the 20 mm septal occlude (small waist and large atrial) was successfully applied to the patient. Immediately after the closure, ICE indicated that there was no atrial septal shunt; the position, size and shape of the device were suitable; and there is no influence to the surrounding structures.

【Key words】 atrial septal defect (ASD); double holes; intracardiac echocardiography (ICE); transcatheter closure

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房间隔缺损(atrial septal defect, ASD)是常见的先天性心脏病,随着经导管介入治疗技术的发展,经皮介入 ASD 封堵术已成为继发孔型 ASD 的主要治疗方法。2003 年张玉顺等^[1]在国内最早开始采

用经胸超声心动图(transthoracic echocardiography, TTE)指导下 ASD 封堵术。近年国内普遍采用经 TTE 指导 ASD 介入治疗,2021 版《常见先天性心脏病经皮介入治疗指南》^[2]指出:经食管超声心动图

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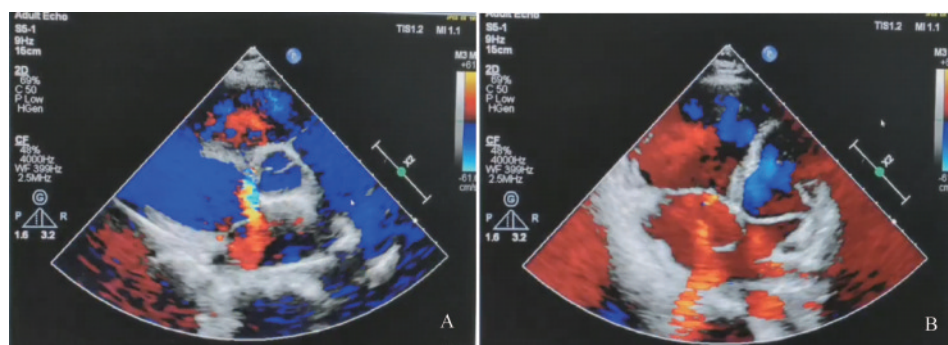
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(transesophageal echocardiography, TEE)主要应用于TTE声窗条件差的患者。受食管条件限制,一些咽喉部或食管病变、手术的患者无法行TEE。本文报道1例因术中TTE声窗条件差及食管条件限制,而应用心腔内超声心动图(intracardiac echocardiography, ICE)指导双孔型ASD进行成功封堵的病例。

病例资料 患者,32岁女性,因“活动后胸闷半年”于2022年1月下旬入院,平时无胸痛、心悸、气急、水肿等症状。2021年10月初复旦大学附属中山医院门诊TTE提示:(1)2处ASD,分别为12 mm和13 mm,两处相距约6 mm,Ⅱ孔型,左向右分流;(2)轻度肺高压(44 mmHg, 1 mmHg=0.133 kPa,下同);(3)右房增大。

入院后血检提示轻度贫血(血红蛋白106 g/L),氨基末端B型利钠肽前体(NT-proBNP)轻度升高(139 pg/mL),其余未见异常。心电图示:窦性心律,不完全性右束支阻滞;胸部X线片:两肺未见活动性病变,心影稍饱满。完善术前相关检查,排除手术禁忌证,在局部麻醉下行左右心导管检查术+

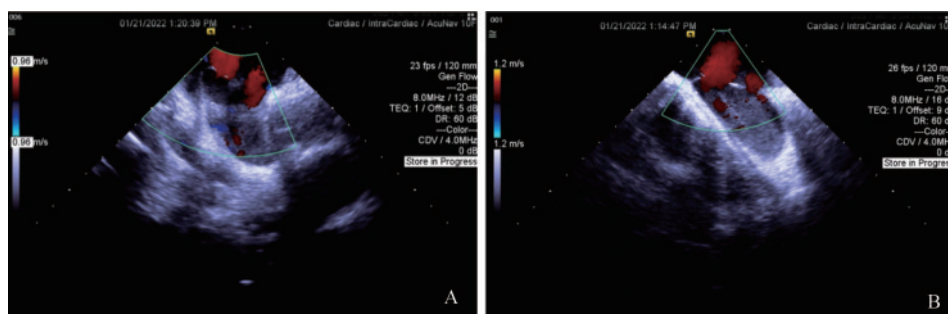
经皮ASD介入封堵术。术中先后3次测得肺动脉压、右室压、右房压、左房压分别为28/9/17 mmHg、32/-1/5 mmHg、6/0/3 mmHg和6/3/5 mmHg。于肺动脉、上腔静脉、下腔静脉等处行血气分析检查,计算 $Q_p:Q_s$ 为1:2.6。本例患者为双孔型ASD,两处缺损大小相似,相距6 mm,一处位于主动脉后方,一处位于后房顶近下腔静脉处。术中TTE的大动脉短轴切面、心尖四腔心切面均不能完整展示两处ASD(图1A、1B)。患者曾接受过声带手术而拒绝接受全麻及TEE,故采用ICE(美国强生公司,ICE导管型号:Sound-Star)行术中指导。术中ICE进一步明确为双孔型ASD(图2A),房缺边缘尚可,质地较硬,未见其他分流。根据指南,由于两处缺损距离 <7 mm,可以考虑采用一个封堵器进行封堵^[3]。在ICE实时监测下,导丝、鞘管依次穿过主动脉根后的13 mm缺损入左房(图2B),依次采用20 mm、22 mm常规型号ASD封堵器对该处缺损进行封堵后,并在ICE引导下分别打开封堵器左房面、腰部及右房面(图3)。



A: Short-axis view of the parasternal aorta in TTE; B: TTE apical four-chamber view showed that the double orifices were not in the same plane, considering that there was partial overlap of the double orifices in this view, and one of the orifices was close to the atrium top with a shorter rim.

图1 术前经胸超声心动图

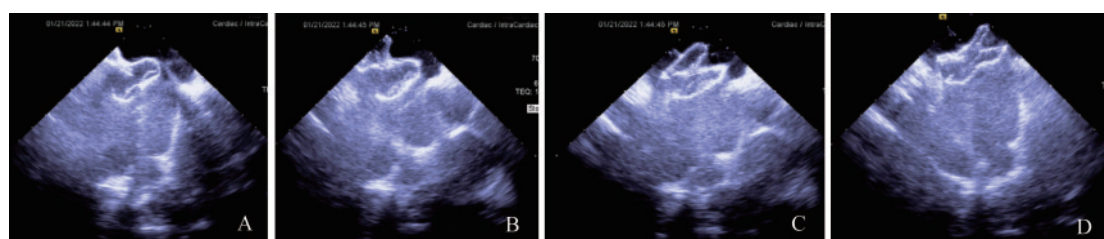
Fig 1 Preoperative transthoracic echocardiography



A: ICE showed a double-hole atrial defect; B: ICE showed that the catheter entered the left atrium through the 13 mm atrial hole.

图2 术中ICE显示ASD数量及导管位置

Fig 2 Number of atrial septal defects and the location of catheter shown by ICE during operation



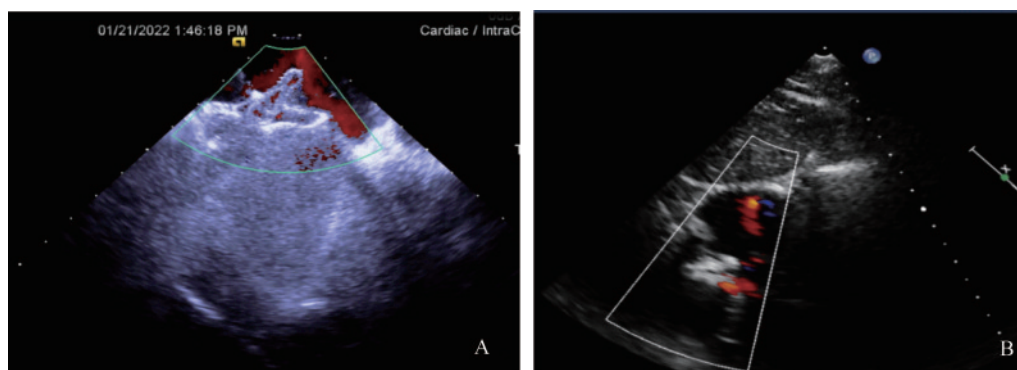
A: Open the left atrial disk of the occluder under ICE; B: Open the waist and part of the right atrial disk of the occluder under ICE; C: Open the right atrial disk of the occluder under ICE completely; D: Release the force of the cable pulling the occluder, and the occluder fits the atrial septum.

图3 ICE实时监测下打开22 mm常规型号ASD封堵器过程

Fig 3 The whole process of 22 mm conventional ASD occluder opening under ICE real-time monitoring

ICE显示另一处缺损不能完全遮盖,仍有较小的房水平分流(图4A),TTE剑突下双房切面亦显示存在房水平分流(图4B),遂考虑采用20 mm大小边ASD封堵器(上海形状记忆合金材料有限公司)对13 mm缺损进行封堵:封堵器左盘面左右裙边各

加12 mm,即左盘面直径大小为44 mm;右盘面左右裙边各加7 mm,即右盘面直径大小为34 mm;利用20 mm封堵器腰部挤压两缺损间的房间隔组织,缩短两处缺损之间的距离,结合左盘44 mm的直径,考虑可同时遮盖两处缺损(总长度约 $12+13+6=31$ mm)。

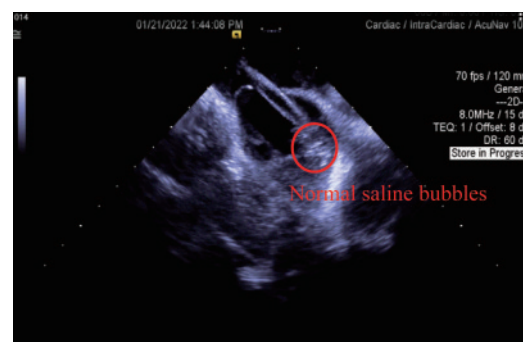


A: ICE showed that the other defect was completely covered and there was still a small amount of shunt; B: TTE showed that there was still a residual shunt at the atrial level in the subxiphoid double atrial view.

图4 术中ICE及TTE图像

Fig 4 Intraoperative ICE and TTE images

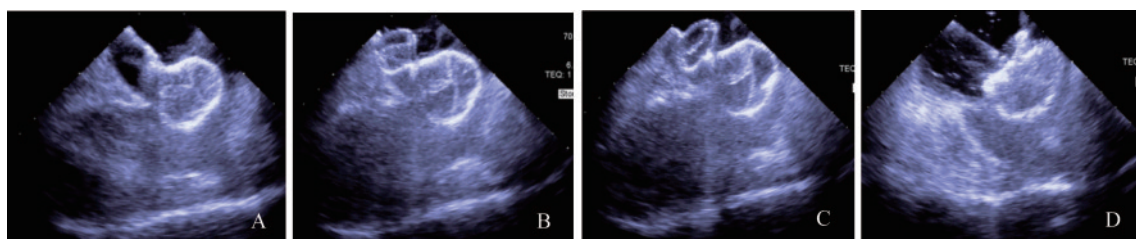
回收22 mm普通封堵器后,鞘管仍保留在左房,此过程均在ICE引导下操作(图5)。随后应用20 mm大小边封堵器进行封堵,操作同前,在ICE下打开封堵器左盘面、腰部及右盘面(图6)。封堵器打开后,ICE显示封堵器与房间隔贴合良好,牵拉稳定,ICE多切面均显示房水平分流消失(图7),并且显示封堵器对周围结构(如二尖瓣、三尖瓣、冠状窦等)均无影响(图8A、8B),整个手术过程中,ICE实时动态监测心腔内结构未受影响,且无心包积液发生;术中应用TTE分别从心尖四腔心切面(图9A)、胸骨旁大动脉短轴切面(图9B)、剑突下双心房切面(图9C)等3个切面检查封堵器,形态和位置均良好,未见房水平残余分流;患者处于清醒状态,无任何不适;数字减影血管造影(digital subtraction angiography, DSA)下见封堵器形态和位置均良好。在ICE指导的DSA



After retrieval of the occluder under ICE, the sheath was retained in the left atrium and injected with normal saline after repumping. ICE showed normal saline bubbles, and the sheath was not attached to the wall of left atrium

图5 ICE下检测保留的鞘管是否贴壁

Fig 5 Checking whether the retained sheath adheres to the wall of left atrium under ICE



A: Open the left atrial disk of the occluder under ICE; B: Open the waist and part of the right atrial disk of the occluder under ICE; C: Open the right atrial disk of the occluder under ICE completely; D: Release the force of the cable pulling the occluder, and the occluder fits the atrial septum.

图6 ICE下打开20 mm大小边封堵器

Fig 6 The whole process of 20 mm septal occluder which is small waist and large atrial opening under ICE real-time monitoring

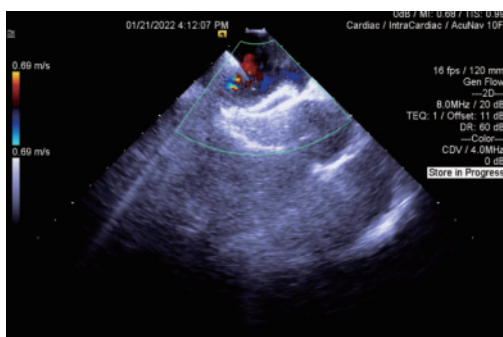
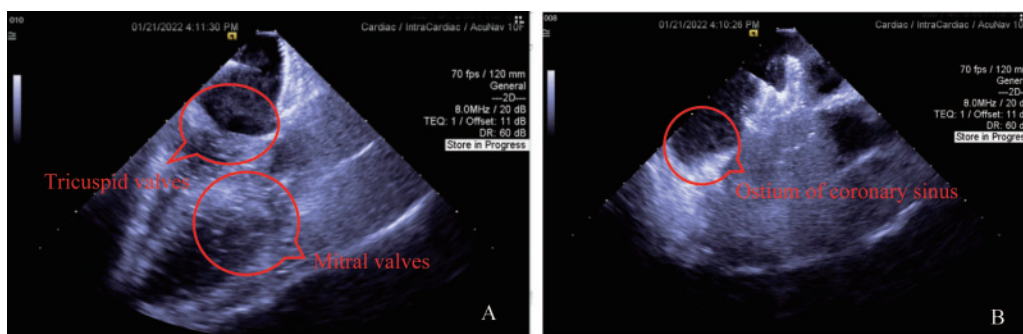


图7 ICE显示房水平分流消失

Fig 7 Disappearance of the atrial level shunt shown by ICE

下释放封堵器,释放后DSA下见封堵器形态、位置良好(图10),释放后ICE下多普勒图像(图11A)显示房水平无分流,结束手术。术后患者无不适,3天后复查TTE显示ASD封堵术后未见房水平分流(图11B)。

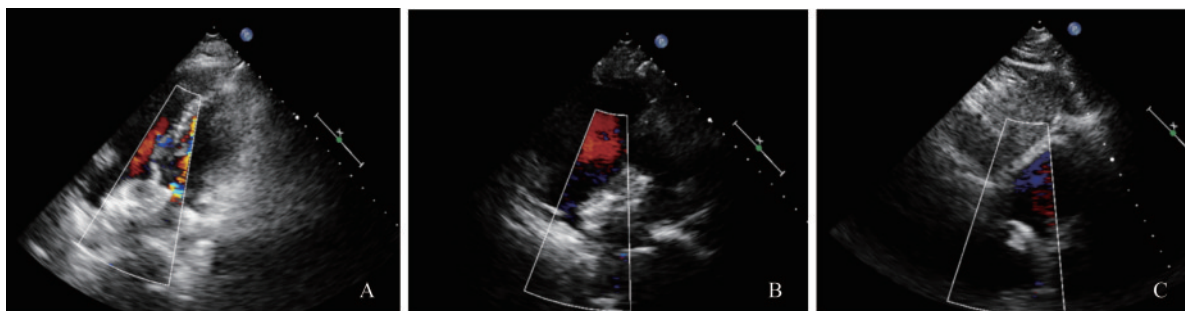
讨论 ASD是常见的先天性心脏病,随着经导管介入治疗技术的快速发展,经皮介入ASD封堵术已成为继发孔型ASD的主要治疗方法。近年来,TTE引导ASD的介入治疗逐步成为国内各大中心应用的普遍手术方案,球囊测量技术、TEE也仅仅



A: The occluder had no effect on mitral valve and tricuspid valve; B: The occluder had no effect on the opening of coronary sinus.

图8 ICE显示封堵器对周围结构无影响

Fig 8 The occluder had no effect on the surrounding structure shown by ICE



A: TTE apical four-chamber view after occluder release during operation; B: Short-axis view of the parasternal aorta in TTE after occluder release during operation; C: Subxiphoid double atrial view in TTE after occluder release during operation

图9 术中封堵器释放后经胸超声心动图显示均无分流

Fig 9 No residual shunt at the atrial level shown by TTE after release of the occluder during operation

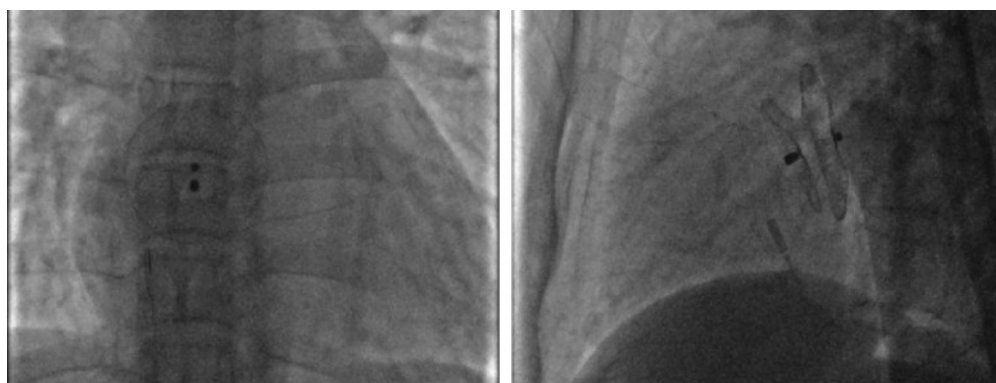
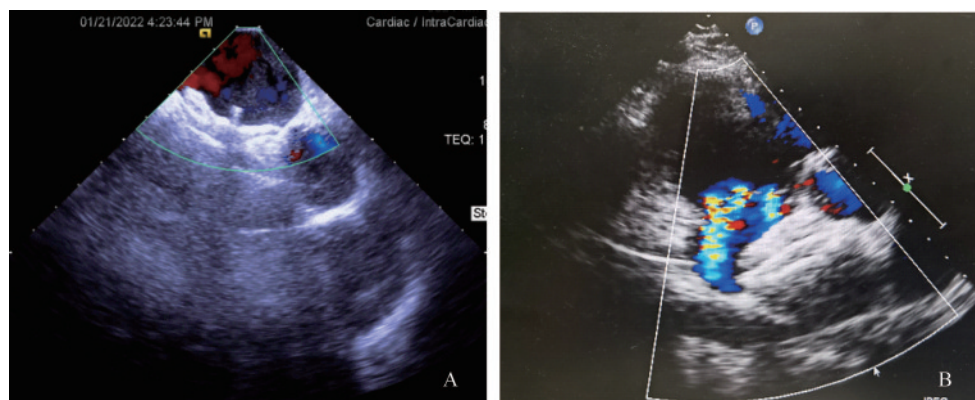


图10 释放后 DSA 下封堵器正位及左前斜下位置及形态良好

Fig 10 The occluder in positive and left anterior oblique under DSA had good position and shape after being released



A: ICE showed that the atrial shunt disappeared completely immediately after release of the occluder, which had good position and shape; B: 3 days after operation, TTE showed that there was no shunt at the atrial level, and no abnormality for the position and shape of the occluder.

图11 术后即刻ICE影像及术后3天TTE影像

Fig 11 ICE image immediately after operation and TTE image 3 days after operation

在极少数较复杂的患者中使用^[4]。TEE主要应用于TTE声窗条件差的患者,是TTE的重要补充^[3]。与传统标准化方案相比,TTE无创、便捷、经济,且并发症少、手术时间短、术后恢复快,目前国内普遍采用TTE辅助介入封堵术来治疗先天性心脏病患者^[5-6]。由于TTE声窗受患者肺气、胃气、胸部毛发、脂肪等影响,并非每个ASD患者均可获得满意TTE视图,特别是剑突下双心房切面,研究显示剑突下双心房切面测得ASD最大直径与术中所用封堵器直径相关性最好^[7],所以并非每个ASD患者均可在TTE协助下完成介入封堵术。

TEE可以清晰显示心脏各结构,针对一些TTE不能获得满意视图及特殊类型ASD,仍需TEE协助完成ASD封堵术^[3],但由于其有创、需要全麻、全程需麻醉医师和超声医师的配合、受食管条件限制,且部分患者因自身因素而不能耐受,部分特殊类型ASD封堵疗效难以保证。

用ICE检测时,其超声探头通过股静脉前行置于右房内,在右房内即可获得清晰的房间隔图像。本例患者术前于中山医院心超室行TTE检查提示为双孔型ASD,但于DSA行ASD封堵术前,超声科医师应用TTE均不能将两处ASD完整地展示清楚,由于房间隔并非一个平面,多孔型ASD的缺损可能不在一个平面上,且缺损数量、大小不一,TTE下大缺损容易干扰心超医师发现小缺损,所以对于多孔型ASD,TTE引导往往受限于心超医师的经验、患者自身的透声条件以及ASD的特殊解剖等因素。本例患者曾行声带手术,拒绝全麻下应用TEE行术中引导,故ICE为术中超声的最佳选择,ICE导管经股静脉进入右房中部,顺时针旋转导管,显示房间隔后,通过调节ICE导管手部旋钮A弯、P弯、R弯、L弯,从而调节ICE导管超声探头扇面,通过房间隔长轴、短轴切面及其他各个切面,准确测量缺损大小、数量、形态及缺损边缘情况,可以更加合理

地指导封堵器型号及大小的选择,并在ASD封堵过程中,清晰显示导丝及输送鞘位置,实时动态监测封堵器左盘面、腰部、右盘面的打开过程。近年来,随着ICE在结构性心脏病介入术中的应用和发展,多项研究比较了TEE与ICE辅助下的ASD封堵^[8-10],发现两者效果相当,但相较于TEE,ICE引导ASD封堵术更加安全且具有无创的优势。

综上所述,大部分继发孔型ASD可以在TTE协助下完成经皮介入封堵术,针对一些特殊类型的继发孔型ASD(如多孔型ASD、大ASD、伴膨出瘤、残端短小或缺如)、TTE声窗条件差、咽喉食管条件受限、不能耐受全麻的ASD患者,可以考虑在ICE协助下进行经皮ASD介入封堵术,作为TEE的良好替代。

结构性心脏病是亟需攻克的难点和热点,ICE在结构性心脏病介入治疗中的应用日趋增多。目前ICE导管成像均为二维成像,成像质量有待进一步提升,实时三维ICE将更好地服务于临床^[11]。在不影响超声图像清晰度的前提下,超声探头及导管可以做到更小、更细,进一步提高患者的舒适度。

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