

# ADVANTAGES AND DISADVANTAGES OF MALE CIRCUMCISION TECHNIQUES: A LITERATURE REVIEW

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## ABSTRACT

**Objective:** To compare the advantages and disadvantages of male circumcision techniques. The articles of male circumcision techniques were investigated from October 2018 to December 2018 through Google Scholar and Proquest. **Material & Methods:** There are various methods of circumcision, these methods can be grouped into two: using shield and clamp devices and conventional methods (dorsal slit and excision). **Results:** The result from this review article are the technique using shield and clamp devices such as the Smart Klamp have several advantages, that are minimal bleeding, rarely injuring the glans penis and faster, but the disadvantage is taken more costs, and often occurs edema in the circumcision area. **Conclusion:** In general, the circumcision method using shield and clamp devices is more beneficial and more practical than conventional methods.

**Keywords:** Circumcision, devices, male, shield and clamp, techniques.

## ABSTRAK

**Tujuan:** Membandingkan keuntungan dan kelebihan dari teknik-teknik sirkumsisi pada laki-laki. Artikel mengenai teknik sirkumsisi ditelusuri dari bulan Oktober 2018 sampai bulan Desember 2018 melalui Google Scholar dan Proquest. **Bahan & Cara:** Terdapat berbagai metode sirkumsisi yang dikelompokkan menjadi dua: metode menggunakan pelindung dan perangkat penjepit dan teknik konvensional (dorsumsisi dan eksisi). **Hasil:** Dari hasil ulasan artikel ini didapatkan bahwa penggunaan metode alat pelindung dan perangkat penjepit, seperti Smart Klamp, mempunyai beberapa kelebihan yaitu perdarahan minimal, jarang melukai glans penis dan waktu yang dibutuhkan untuk proses sirkumsisi lebih cepat, sedangkan kelemahannya yaitu biaya yang diperlukan lebih besar dan seringkali terjadi edema pada daerah sirkumsisi. **Simpulan:** Secara umum, metode sirkumsisi menggunakan alat pelindung dan perangkat penjepit lebih baik dan praktis dibandingkan teknik konvensional.

**Kata Kunci:** Sirkumsisi, alat, laki-laki, pelindung dan penjepit, teknik.

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## INTRODUCTION

Circumcision is the surgical or excision of the foreskin (preputium) on the penis, and indeed most often and is generally done in men, although there are some circumcision in women.<sup>1-2</sup> Globally, >25% of the world's male population perform circumcision.<sup>1</sup> In the United States, the average the rate of circumcision on men is quite high at around 70% and indeed the average newborn baby in America has been circumcised.<sup>2-3</sup> Besides, in Nigeria the average circumcision rate in men is higher about 87%.<sup>4</sup> This is indeed influenced by several factors

such as culture, beliefs, ethnicity, tradition, and health factors.<sup>5</sup> Circumcision is usually carried out especially during infants or children. In terms of community health, circumcision has advantages in preventing HIV disease. And from a medical point of view, it can reduce the rate of transmission of sexually transmitted diseases.<sup>1,2,6,7</sup>

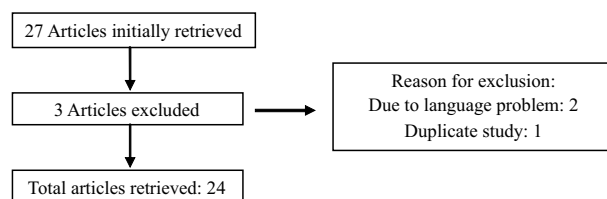
The American Academy of Pediatrics (AAP) also recommends newborn baby boys must be circumcision.<sup>2</sup> As we know, many male circumcision techniques, from conventional circumcision techniques to modern techniques using tools such as cauter, laser to shield, and clamp

devices. Because of the development of science and technology, many people who want to be circumcised in a way that can make circumcision wounds heal quickly, without pain and sewing, and head and clamp devices are made for circulation. Here we will compare and describes the advantages and disadvantages of techniques male circumcision.

## OBJECTIVE

The purpose of this review article is to compare the advantages and disadvantages of male circumcision techniques.

## MATERIAL & METHODS



**Figure 1.** Research Conceptual Framework.

References were searched from October 2018 to December 2018 by searching through the Google Scholar database and Proquest database. The references were searched using the terms “circumcision”, “male circumcision”, “circumcision procedure”, “cost of circumcision” and “technique of circumcision”. Initially, there were a total of 27 articles collected. The plan is to include all studies published in English, regardless of the year of publication. Two articles were excluded from this review because they were published in languages other than English; French and Spanish. Another article was excluded because it is a duplicate of an existing study. Therefore, there are 24 remaining articles used in this review.

The principles of circumcision are asepsis, adequate excision of outer and inner preputial skin layers, hemostasis, protection of the glans and urethra, and cosmesis. The goal of the procedure is to expose the glans sufficient to prevent phimosis or paraphimosis. Circumcision methods can be classified into two thereof: conventional circumcision (without devices) and shield and clamp devices.<sup>8-9</sup> Many of the methods in use today fall into one of these major classes. Shield and clamp adopt the use of the device to effect circumcision obviating

the use of knife in majority of cases. The device method is the commonly used method of circumcision in recent practice.

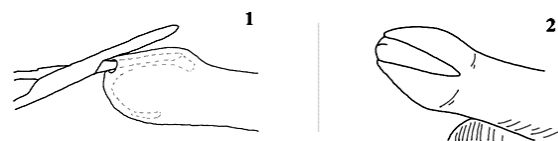
The procedure is done under local anesthesia. There are many ways of achieving this: penile ring block, penile dorsal nerve block, and local anesthetic spray jet injector have all been described.<sup>10-12</sup> While the spray injector procedure requires an appliance that is uncommon and expensive, penile dorsal nerve block and the ring penile block can be easily learned and carried out by all.<sup>10-11</sup>

Penile dorsal nerve block is a safe and appropriate anesthesia technique for circumcision procedure. The block aims to deliver adequate local anesthetic agent at a dose of 1 ml + 0.1 ml/kg bodyweight around the main trunk of the dorsal nerve of the penis and its ventral branch.<sup>10</sup> This is easily accessible just below the symphysis pubis deep to the fascia and on either side of the penile suspensory ligament. Care is taken to avoid the midline where dorsal vessels that may be the cause of hematoma and poor nerve block passes. For the position, the patient is placed supine, with the legs astride to expose the penis. The penis and the immediate surrounding area is prepped with povidone-iodine and draped with a perineal sheet before anesthesia.

## Conventional Circumcision

### 1. Dorsal Slit

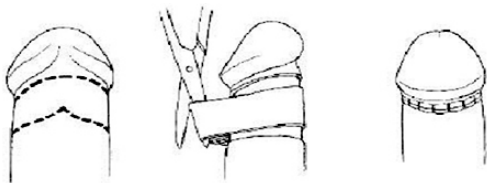
Dorsal slit (Figure 2) is common to many techniques and occasionally is used alone, especially in the presence of acute inflammation. Dorsal slit prevents both phimosis and paraphimosis. In this procedure, the prepuce is freed from the glans of adhesions and with the aid of artery forceps placed at 10 and 1 o'clock, a 12 o'clock slitting of both layers of the prepuce is done to some few millimeters of the corona.<sup>11,13</sup> Many of other techniques of circumcisions require dorsal slit to be carried out first to widen the outer preputial ring.<sup>14</sup> Usually, it is cosmetically unacceptable to carry out dorsal slit alone without excising the prepuce.



**Figure 2.** Dorsal slit technique.<sup>15</sup>

## 2. Excision

**Sleeve Resection:** The prepuce is retracted over the glans penis (Figure 3) and a circumferential incision is made around the shaft as far back as the scar line is to be placed, usually distal to the corona. The prepuce is returned to cover the glans and another circumferential incision is made around the shaft at the same position as the first one. A longitudinal cut is made between the two circumferential ones and the strip of skin removed. The free raw edges are then sutured. The frenulum can be included in the main cutting or can be cut separately if desired. The glans and frenulum are not protected as such and care is taken not to injure them.<sup>11,13</sup>



**Figure 3.** Sleeve resection technique.<sup>16</sup>

## Shield and Clamp Devices

### 1. Mogen clamp

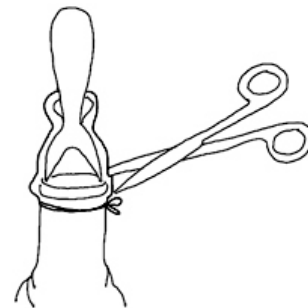
Mogen clamp uses a shield and clamp method (Figure 4). In this method, the prepuce is pulled out distal to the glans and a metal shield is slid over the prepuce immediately distal to the glans. A scalpel is used to remove the redundant prepuce distal to the shield. The glans is protected by the shield and the frenulum is not involved in the excision.<sup>11</sup> The inner preputial layer may then be slit back behind the glans and excised, this ensures full exposure of the glans after healing. No stitching is done, the wound simply being bandaged to achieve hemostasis. The glans and the frenulum are shielded from the knife and thus are off the harm's way.<sup>17-18</sup>



**Figure 4.** Mogen clamp techniques.<sup>19</sup>

## 2. Plastibell Devices

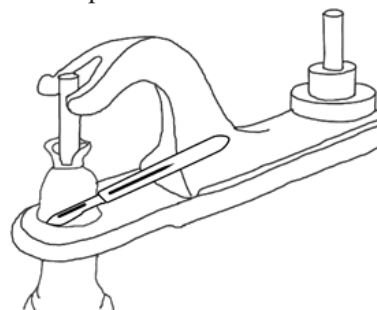
A plastibell (Figure 5) with a groove on its back is slipped between the glans and the prepuce, an initial dorsal slit (Figure 2) is usually needed to allow the bell to be placed. The prepuce is pulled slightly forward and suture material is looped around in the groove and tied tightly.<sup>5,11,13,14</sup> The suture cuts off the blood supply to the prepuce distal to the groove, which withers and drops off in 7-10 days. The Plastibell comes in 6 sizes. The appropriate one is chosen and applied to the glans.



**Figure 5.** Plastibell technique.<sup>16</sup>

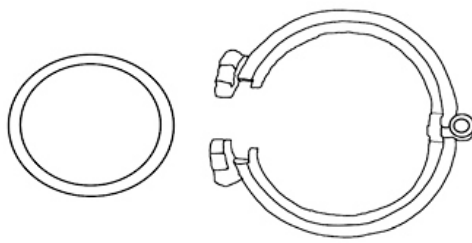
## 3. Gomco Clamp

A metal bell (Figure 6) is placed over the glans after the prepuce is fully retracted. The prepuce is then replaced over it this is facilitated by the dorsal slit. A metal plate, with a machined under the surface in which the rim of the bell sits, is placed over the bell.<sup>11,13</sup> The prepuce thus lies between the plate and the bell. A tensioning bar is hooked under a T-shaped piece on the top of the bell and screwed down tight to the metal plate; this traps the foreskin in position. A scalpel is run around the upper surface of the plate to remove the prepuce after adequate strangulation.<sup>11,13</sup> Catastrophe resulting in whole penile loss occurs when this procedure is done with diathermy. Its main merit like another shield method is that the glans and the frenulum are protected.



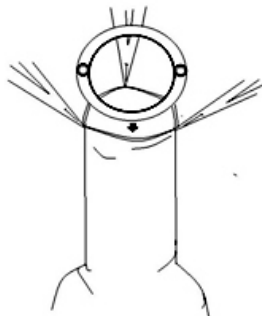
**Figure 6.** Gomco clamp technique.<sup>20</sup>

#### 4. Zhenxi Rings/Shenghuan disposable Device



**Figure 7.** Zhenxi Ring and Shenghuan disposable device.<sup>17-18</sup>

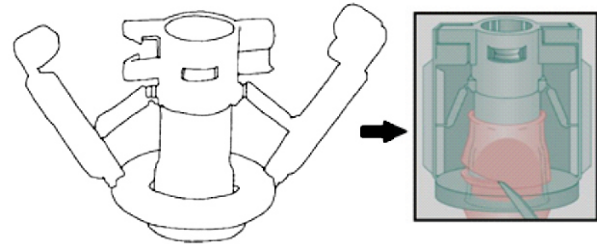
Zhenxi rings similarly with shenghuan disposable device (Figure 7). The foreskin was first separated from the glans, and the inner ring was placed between them (Figure 8), encircling the corpus and over the glans. After adjusting the position of the inner ring to retain 0.5cm of the inner prepuce, the operator installed the outer ring over the prepuce, and on the inner ring, gently fixed the first tooth and made some moderate adjustments to completely protect the frenulum, then the second tooth was tightly fixed. Removal of the excess foreskin was then carried out with the device. The device would fall off on its own within 2–3 weeks. If not, it would be removed by a surgeon 21 days after the operation.<sup>17-18</sup>



**Figure 8.** The inner ring was placed between the foreskin and the glans, encircling the corpus and over the glans.<sup>17</sup>

#### 5. Tara Klamp

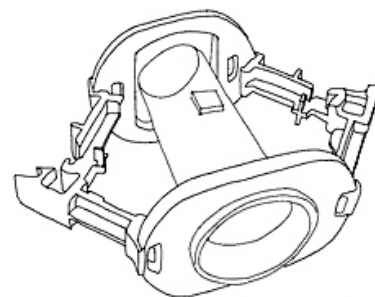
A Malaysian invention (Figure 9), it is very similar to the plastibell except that instead of having to tie suture material around a groove in the bell, plastic arms lock into place to force two surfaces into tight contact; with the prepuce trapped between them. Its merits and drawbacks are similar to that of plastibell.<sup>18</sup>



**Figure 9.** Tara klamp technique.<sup>18</sup>

#### 6. Smart Klamp

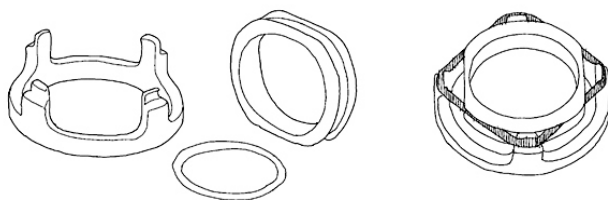
This works in the same way as the Tara Klamp. By trapping the prepuce between an outer ring and an inner tube, the device cuts off the blood supply to the prepuce. The Tara Klamp is a one-piece design with the locking arms at the top. Smart Klamp (Figure 10) consists of the separate inner tube and outer locking part with the locking arms at the side. Once the clamp is in place the excess foreskin is removed using the inside of the baseplate as a guide.<sup>18,21</sup> The glans and frenulum are thus protected.



**Figure 10.** Smart clamp technique.<sup>18,21</sup>

#### 7. PrePex<sup>®</sup>

This device is unique because of its use in adult male circumcision without the need for anesthesia. It consists of a placement ring, an inner ring, and an elastic ring. The placement ring is a carrier for the elastic ring to facilitate the application of the latter during the procedure. The inner ring has a groove on it for the lodgment of the elastic ring. When the device is applied, the prepuce is sandwiched between the inner ring and the elastic ring. The PrePex (Figure 11) device is disassembled at about a week after placement and the withered prepuce is bloodlessly severed from the penis. It is said to be safe and effective in mass rollout of adult male circumcision for the prevention of HIV infection.<sup>5,6,22</sup>



**Figure 11.** The PrePex® device and how to use.<sup>22</sup>

## RESULTS

Circumcision is one of the most universally carried out operations worldwide, and its noticeable benefits are emphasized by many studies. However, there are probably some complications with it, such as edema, pain, and others. Because of that, considerable development in the materials and techniques used for circumcisions, such as the shield and clamp devices named Gomco, Mogen Clamps, Plastibell, Tara Klamp, Smart Klamp, and the others have been made to an attempt to minimize the incidence of complications and ease in circumcision.<sup>17</sup>

In many countries, surgical methods often use a procedure that protects the penis during excision of the foreskin. In the USA the most commonly used devices are the GOMCO (Goldstein Medical Company) clamp (67%) invented in 1934, MOGEN clamp (10%) invented in 1945 and

PlastiBell (19%).<sup>17-18</sup> Comparison of advantages and disadvantages between conventional techniques and head and clamp devices are shown in the table below (Table 1).

## DISCUSSION

Mogen clamp is one of the clamp devices. In this method, injury to the glans, bleeding, and urethrocuteaneous fistula can occur, but uncommon. Another disadvantage result of this method is the formation of a skin bridge between the penile shaft and the glans. Smegma may accumulate under the skin bridges. Additionally, these bridges may tether the erect penis, with resultant pain or penile curvature. It's also can happen for the other devices. Besides that, more attention is needed when clamping the foreskin, because if there is negligence, it's can clamp the glans penis causing injury and there is greater potential for accidentally removing the tip of the penis (glans). But, this technique is faster than conventional methods such as dorsal slit and excision. This method requires 5 minutes of clamping to prevent post-operative bleeding.

Plastibell device is quite practical and safer than the Mogen clamp, but glans necrosis and failure of the prepuce to fall-off are the two main complications of this technique. Inappropriate bell size and not tight enough suture over the prepuce are the main cause of these complications. Its main

**Table 1.** Advantages and Disadvantages of Male Circumcision Techniques or Devices.

Advantages/ Disadvantage	Techniques or Devices						
	Mogen Clamp	Plastibell	Gomco Clamp	SHD* and ZR*	TK* and SK*	Prepex	DS <sup>▲</sup> and Ex <sup>◄</sup>
<b>Bleeding</b>	minimal	minimal	minimal	minimal	minimal	(-) /minimal	minimal to severe
<b>Pain</b>	frequent	uncommon	uncommon	frequent	uncommon	uncommon	frequent
<b>Glans Injury</b>	possible	rare	rare	rare	(-)/rare	(-)/rare	possible
<b>Skin Bridge</b>	possible	rare	rare	possible	possible	possible	rare
<b>Infection</b>	+/-	+/-	+/-	+/-	+/-	+/-	+/-
<b>Edema</b>	rare	frequent	rare	frequent	frequent	rare	rare
<b>Fistulas</b>	very rare	very rare	very rare	very rare	very rare	(-)	very rare
<b>Operating time</b>	=5 minutes	5 – 10 minutes	= 10 minutes	2.5 - 3.5 minutes	5 – 8 minutes	< 5 minutes	15-30 minutes
<b>Cosmetic result</b>	good	good	good	good	good	good	poor/good**
<b>Others</b>	Fistula (very rare)	Necrosis (very rare)	Necrosis (very rare)	Urinary retention (very rare)	(-)	Urinary retention (very rare)	Expert needed

\*Shenghuan Disposable device, •Zhenxi Ring, ♦Tara Klamp, ■Smart Klamp, ▲Dorsal Slit, ◄Excision (Sleeve Resection), \*\*depend on expert or non-expert.



advantage is low risk of bleeding. The entire procedure takes 5 to 10 minutes, depending on the experience and skill of the operator. The ring falls off in 3 to 7 days leaving a circumferential wound that will heal over the following week.

Then the Gomco Clamp is one of the shield and clamp devices also and it was the most popular method for circumcisions between 1950 and 1980 and is still common today, especially in the USA. Gomco clamp is a fairly bloodless circumcision technique. The circumcision is relatively quick compared to the Plastibell, the total procedure takes less than 10 minutes for expert. It has the advantages of a steel bell that protects the glans penis during the procedure and the absence of a foreign body remaining at the site afterward. But, Applying the Gomco clamp is more complex than the other methods of circumcision, such as the Plastibell device and the Mogen clamp. It's needed to learn how to use this device.

The Shenghuan disposable device and Zhenxi Ring are minimally invasive Circumcision anastomosis device, developed in China involves minimal tissue manipulation and is said to give a simpler, quicker, and safer circumcision than conventional techniques. It was tested on 1.200 patients aged 5-95 years. Operating time was 2.5-3.5 minutes, after which it is worn for a week, with no incidents of device dislocation or damage to the frenulum. The incision healed, leaving minimal inner foreskin, with no scarring and good cosmetic results. But, the device has disadvantages such as using the device could lead to more pain six hours after surgery and penile edema.<sup>17-18</sup>

Tara Klamp and Smart Klamp has a similar technique by trapping the preputium between an outer ring and an inner tube, the device cuts off the blood supply to the prepuce. Circumcision with Smart Klamp and Tara Klamp device was faster when compared to the conventional technique. It's also easy to use for expert or nonexpert and the operative time is 5-8 minutes. Cosmetic results and complication rates were similar. Unfortunately, this technique seemed to carry the disadvantages of longer mucosal length, penile edema, and higher parental anxiety.

The PrePex circumcision device was prequalified by WHO in May 2013 to enable global HIV prevention.<sup>22-23</sup> The PrePex device also practical to use and has simple procedure but the same as the Gomco clamp, Shenghuan device, and Zhenxi Ring needed to learn how to use to minimize

complication. It requires less than 5 minutes for both placement and removal and has a good cosmetic result. PrePex device male circumcision also cheaper than surgery, especially in Africa and Europes.<sup>24</sup> It is considered safe and effective in mass rollout of adult male circumcision for the prevention of HIV infection.<sup>18</sup> The disadvantages of this device are bleeding after removing the device especially the patient self-removal of the device that can lead to serious complications. Furthermore, pain, bad odor, and difficulty to urinate occurred in some patients.

Dorsal slit technique is one of the techniques of circumcision that is used to treat acute inflammation such as phimosis or paraphimosis. This technique is still often used in many countries, especially in developing countries. This technique requires the surgical skills of the operator, needed sutures and scalpel or tissue scissors and also anesthetic injections. The advantage of this technique is that we can adjust how short the foreskin is cut so the risk of redundant preputial skin is minimized. The cosmetic results aren't good than shield and clamp devices especially if used by nonexpert and sometimes the area of the frenulum is also cut off or injured when performing the procedure.<sup>18,24</sup> Furthermore, this technique takes longer time, around 15-30 minutes depending on the operator's skill.<sup>11,13</sup>

The last is the excision technique (sleeve resection) same as the dorsal slit the frenulum can be included in the main cutting or can be cut separately if desired. The glans and frenulum are not protected. The other complication are bleeding (rare but definite), infection, and residual excess skin remaining.

All circumcisions should involve adequate anesthesia, using either EMLA cream, dorsal penile nerve block, penile ring block, or a combination of these before the operation.

## CONCLUSION

Male circumcision is one procedure that is most commonly performed in daily practice. This is due to factors of religion, tradition, beliefs, health, and prevention of sexually transmitted diseases such as HIV. Besides that, many techniques of circumcision are now available from conventional circumcision to using shield and clamp devices. Where each technique and devices have advantages and disadvantages. In general, shield and clamp devices is generally more beneficial and acceptable

than conventional circumcision, but it all depends on each case and the patient's request and cost. Mild to severe complications can occur in all techniques or devices, the important and significant things are the skill of the operator and patient compliance during treatment after circumcision. Aware of this, there is still a great need for prospective and analytical studies to find out the advantages and disadvantages of each technique of male circumcision and minimize the complication.

## REFERENCES

1. Moses S, Bailey RC, Ronald AR. Male circumcision: assessment of health benefits and risks. *Sex. Transm. Infect.* 1998; 74: 368–373.
2. Blank S, Brady M, Buerk E, Carlo W, Diekema D, Freedman A, et al. American Academy of Pediatrics, Task force on Circumcision: Male circumcision. *Pediatrics.* 2012; 130: e756–85.
3. Gerharz EW, Haarmann C. The first cut is the deepest? Medicolegal aspects of male circumcision. *BJU Int.* 2000; 86: 332–8.
4. Rickwood AM. Medical indications for circumcision. *BJU Int.* 1999; 83: 45–51.
5. Morris BJ. Why circumcision is a biomedical imperative for the 21(st) century. *Bioessays* 2007; 29: 1147–1158.
6. Bitega JP, Ngeruka ML, Hategekimana T, Asiimwe A, Binagwaho A. Safety and efficacy of the PrePex device for rapid scale-up of male circumcision for HIV prevention in resource-limited settings. *J Acquir Immune Defic Syndr.* 2011; 58: e127–34.
7. U.S. Centers for Disease Control and Prevention (CDC). Background, methods, and synthesis of scientific information used to inform the "Recommendations for providers counseling male patients and parents regarding male circumcision and the prevention of HIV infection, STIs, and other health outcomes." [Docket No. CDC-2014-0012-0002]. <https://www.regulations.gov/document?D=CDC-2014-0012-0002> (Accessed September 14, 2018).
8. Gerharz EW, Haarmann C. The first cut is the deepest? Medicolegal aspects of male circumcision. *BJU Int.* 2000; 86: 332–8.
9. Kaplan GW. Complications of circumcision. *Urol Clin North Am.* 1983; 10: 543–9.
10. Brown TC. The anatomy and technique of penile block. *Update Anaesth.* 1993; 2: 11–2.
11. Geneva: World Health Organization. WHO/UNAIDS/JHPIEGO. Manual for male circumcision under local anaesthesia (accessed 2018).
12. Peng Y, Masson P, Li PS, Chang Y, Tian L, Lee R, et al. No-needle local anesthesia for adult male circumcision. *J Urol.* 2010; 184: 978–83.
13. Weiss H, Polonsky J, Bailey R, Hankins C, Halperin D, Schmid G. Male circumcision: Global trends and determinants of prevalence, safety and acceptability. World Health Organization and the Joint United Nations Programme on HIV/AIDS (UNAIDS). Available from: [http://data.unaids.org/pub/Report/2007/jc1360\\_male\\_circumcision\\_en.pdf](http://data.unaids.org/pub/Report/2007/jc1360_male_circumcision_en.pdf). (accessed Dec 01, 2018).
14. Barrie H, Huntingford PJ, Gough MH. The plastibell technique for circumcision. *BMJ.* 1965; 2: 273–5.
15. Reichman EF. *Emergency Medicine Procedures*. 2nd Ed. 2013. Available from: [www.accessemergencymedicines.com](http://www.accessemergencymedicines.com) (accessed Dec 03, 2018).
16. Circumcision Clinic Cardiff. Circumcision Methods. 2015. Available from: <http://www.circumcisionincardiff.co.uk/circumcision-methods/> (accessed Dec 03, 2018).
17. Pan F, Pan L, et al. Circumcision with a novel disposable device in Chinese children: A randomized controlled trial. *International Journal of Urology.* 2012. Available from: <https://onlinelibrary.wiley.com/doi/10.1111/j.1442-2042.2012.03132.x> (accessed Dec 05, 2019).
18. Goldman R, Montagu A. Circumcision: The Hidden Trauma. How an American Cultural Practice Affects infants and Ultimately Us All. Available from: <https://circumcision.org/gomco-clamp/> (accessed Dec 05, 2018).
19. Doctorlib. *Obstetrics and Gynecology*. 7 Ed. Chapter 10. Immediate Care of the Newborn. 2017. Available from: <https://doctorlib.info/gynecology/obstetrics-gynecology/10.html> (accessed Dec 05, 2018).
20. Ahmed AA, Mungadi IA. Techniques of Male Circumcision. *J Surg Tech Case Rep.* 2013; 5(1): 1–7.
21. Karadag MA, et al. SmartClamp circumcision versus conventional dissection technique in terms of parental anxiety and outcomes: A prospective clinical study. *Can Urol Assoc J.* 2015; 9(1-2): E10–E13.
22. Prepex. Clinical Procedure. PrePex Non-Surgical Male Circumcision Procedure for Adults and Adolescents. 2018. Available from: <http://prepex.com/device-overview/clinical-procedure/> (accessed Dec 06, 2019).
23. Minja M, et al. Journal of the Association of Nurses in AIDS Care. 2016; 27(6): 784–791.
24. Schutte, et al. Comparative Cost Analysis of Surgical and PrePex Device Male Circumcision in Zimbabwe and Mozambique. *JAIDS Journal of Acquired Immune Deficiency Syndromes.* 2016; 72: 96–100.