Application of the Mathieu combined tunnel technique for repairing glans dehiscence after failed hypospadias repair

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Repairing glans dehiscence after failed hypospadias repair is challenging for pediatric surgeons. Here, we introduced and evaluated a newly modified Mathieu technique, Mathieu combined tunnel (MCT), which involves multiple custom-designed flaps for the shortage of flap source material after repeated operations; we also constructed a tunnel to avoid the glans incision that may carry new risks of dehiscence. This retrospective study included 26 patients who were consecutively admitted to the First Affiliated Hospital of Sun Yat-Sen University (Guangzhou, China) for glans dehiscence repair after failed hypospadias repair from October 2014 to October 2020; sixteen patients underwent surgery using the MCT (MCT group) and ten patients underwent surgery using the tubularized incised plate (TIP) technique (TIP group). The operative time, blood loss, postoperative complications, normal urethral meatus rate, success rate, and Hypospadias Objective Penile Evaluation (HOPE) score were compared between the two groups. The MCT group achieved an overall satisfactory penile appearance and voiding function, with a higher rate of normal urethral meatus (15/16, 93.8%) and a lower rate of glans dehiscence (1/16, 6.2%), compared with the TIP group (70.0% and 30.0%, respectively). However, these differences were not statistically significant, possibly because of the limited number of patients (all P > 0.05). Mean postoperative HOPE scores were similar in the MCT group (mean ± standard deviation: 8.83 ± 0.89) and TIP group (8.94 ± 0.57) (P > 0.05). No significant differences were found between the two groups in terms of blood loss and success rate, nor in the rates of various complications (e.g., fistula, urethral stricture, and glans dehiscence). In conclusion, the MCT technique appears to be feasible and reliable for repairing glans dehiscence after failed hypospadias repair.

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INTRODUCTION

Congenital hypospadias is one of the most common male urogenital tract malformations, affecting approximately 1 in 150–300 newborn boys.¹ The main goals of hypospadias repair surgery are to correct abnormal ventral curvature of the penis (chordee), reconstruct the urethra with a normal urethral meatus, and achieve a satisfying functional and cosmetic outcome. In pursuit of these goals, over 300 surgical procedures have been described; the exploration of novel techniques with lower risk of complications and better outcomes is ongoing.¹ Unfortunately, despite intensive efforts to improve the corresponding surgical techniques over multiple decades, the incidence of postoperative complications remains in the range of 3.32%–22.14%.² Short-term postoperative complications include urethrocutaneous fistula, urethral stricture, glans dehiscence, and urethral diverticulum; long-term postoperative complications include lower urinary tract symptoms (LUTS), unsatisfactory penile appearance, chordee, and infertility.³⁻⁵ These complications affect the physical and psychological development of boys with hypospadias, usually requiring repeated operations.⁵⁻⁶ Moreover, abnormal urination posture and repeated hospitalizations may lead to social phobia and personality disorders.⁶

Glans dehiscence is one of the most common serious postoperative complications of hypospadias repair, which commonly leads to the pursuit of revision urethroplasty.⁷ Repairing glans dehiscence after failed hypospadias repair is challenging for pediatric surgeons because of multiple surgical problems, such as an insufficient source of flap materials, urethral plate scar formation, and increased psychological stress in both patient and surgeon; other problems include high risks of new glans dehiscence and fistula.⁶ For these reasons, a superior technique is required to obtain a satisfactory outcome and avoid repeated failures after repair.

Mathieu urethroplasty is a classic technique that uses the meatal-based flap as urethral material; this technique is mainly indicated for patients with distal hypospadias, as well as patients with failed hypospadias.⁵⁻⁷ However, the classic Mathieu technique may produce an abnormal opening of the urethral meatus (such as a fish-mouth-like opening at the ventral side of the penis, rather than a slit-like opening at the tip of the glans penis); moreover, its flap selection method is monotonous,⁸⁻⁹ which limits its application in patients with failed hypospadias who exhibit varied anatomy. In patients with failed hypospadias, the urethral materials are usually irregularly distributed.
around the urethral meatus after urethral dehiscence, which limits the application of revision urethroplasty using a traditional metatral-based flap. Moreover, during the classic procedure, a glans incision is performed to reconstruct the urethra, which may carry new risks of glans dehiscence. Therefore, the Mathieu technique must be modified in accordance with the needs of real patients. In our center, we have been using a newly modified Mathieu technique for 7 years, Mathieu combined tunnel (MCT), which involves multiple custom-designed flaps to address the problem of insufficient flap source material; we have also constructed a tunnel through the glans to the new opening of urethral meatus at the tip of the glans penis, thus avoiding a glans incision. The first aim of this study was to introduce the MCT technique. The second aim of this study was to evaluate the superiority of the MCT technique by comparison with the tubularized incised plate (TIP) technique, another procedure widely applied in the repair of failed hypospadias.

PATIENTS AND METHODS

Patients
The study was approved by the Ethics Committee of the First Affiliated Hospital of Sun Yat-sen University (Guangzhou, China; approval number: [2021]095) and the informed consent was exempt for the study was retrospective; the study was performed in accordance with the tenets of the Declaration of Helsinki. Clinical data and outcomes were collected regarding consecutive patients with glans dehiscence after failed hypospadias repair who were admitted to our center from October 2014 to October 2020. The inclusion criteria were as follows: complete clinical data and successful follow-up; failed hypospadias (i.e., glans dehiscence with the urethral meatus opening at the middle penis, distal penis, or coronary sulcus; the concomitant fistula was located in the proximal penis or scrotum, far from the urethral meatus to enable separate closure); and the MCT or TIP technique was adopted. Duckett or free foreskin graft urethroplasty was not performed in any patient because the foreskin had been previously removed in all patients. The operations were performed by three surgeons (CS, Li Zhou, and Zhe Xu; each surgeon has performed over 300 hypospadias repairs) in our center. The patients were allocated into MCT or TIP groups according to the urethral plate findings: if the urethral plate was sufficiently wide with mild scarring, the TIP technique was attempted first; if the urethral plate was extremely narrow or exhibited severe scarring, the MCT technique was used.

MCT technique
After general endotracheal anesthesia and disinfection, an anchoring suture was placed on the glans penis. The chordee was evaluated under artificial erection, and the proximal urethra was checked to exclude strictures and diverticula. On the basis of the patient’s age and the width of the glans penis, a suitable urethral stent was selected and inserted using either a 6–10-Fr Foley catheter (CLINY, Dalian, China) or a multihole urethral stent (10-Fr ventricular drainage tube, Life Science Corporation, Yangzhou, China). The incision extending to the tunica albuginea was made on the basis of the available skin tissue, enabling the harvest of a proximal rectangular flap (Figure 1a and 2a), distal Y-shaped flap (Figure 2e), or distal rectangular flap (Figure 2i). The flap length was identical to the length of the urethral defect; its width was 1–1.2 cm. A sufficient amount of subcutaneous tissue was reserved around the meatus to ensure flap vascularity. The chordee was corrected after flap dissection, if necessary. The flap was then turned over distally, or turned toward the midline, to prepare for urethroplasty. The flap was sutured around the stent using 6/0 absorbable sutures with a subcuticular continuous suture technique to achieve urethroplasty.

Figure 1: Mathieu combined tunnel technique. (a) Incision and meatal-based flap. (b) Construction of tunnel. (c) Urethroplasty. (d) The neourethra was passed through the tunnel. (e) Incision suture. (f) Postoperative voiding.

TIP urethroplasty technique
TIP urethroplasty was performed in accordance with standard technique. The selection of stent and urine drainage in the TIP group was identical to the method used in the MCT group.

Postoperative management
Patients in both groups underwent identical postoperative management. First- or second-generation cephalosporins were injected for 3 days. Patients in both groups underwent identical postoperative management. First- or second-generation cephalosporins were injected for 3 days. The stent was cleared daily at 3 days postoperatively; the final follow-up assessments were performed in March 2021 with a similar follow-up length between the MCT (mean ± standard deviation: 32.3 ± 17.9 months) and TIP (29.1 ± 20.8 months) groups.

Follow-up
Follow-up was conducted via telephone, WeChat, or outpatient review to evaluate each patient’s complications, voiding function (satisfactory voiding function was defined as a thick urinary stream with no hesitancy or difficulty), and penile appearance. The patients were regularly followed up by the surgeons at 1 month and 6 months postoperatively; the final follow-up assessments were performed in March 2021 with a similar follow-up length between the MCT (mean ± standard deviation: 32.3 ± 17.9 months) and TIP (29.1 ± 20.8 months) (P = 0.68) groups. Analyzed factors included rates of urethrocystic fistula, urethral stricture, glans dehiscence, wound infection, chordee, LUTS, normal urethral meatus (i.e., at the tip of the glans penis, slit-like, and vertical) and success (normal urethral meatus, without complications involving fistula, urethral diverticulum, severe urethral stricture, or chordee), and Hypospadias Objective Penile Evaluation (HOPE) score (total score = 10 points).
Statistical analyses
SPSS Statistics version 22.0 (IBM, Armonk, NY, USA) was used for statistical analysis; comparisons between groups were performed using the Chi-squared test, Fisher’s exact test, and Student’s t-test. The data are presented as mean ± standard deviation (s.d.). \( P < 0.05 \) was considered statistically significant.

RESULTS
Patient characteristics
In total, thirty-six consecutive patients with glans dehiscence after failed hypospadias repair visited our center and underwent surgeries from October 2014 to October 2020. Five patients with incomplete data and failed follow-up were excluded, as were 5 patients who underwent free skin graft or two-stage repair. The remaining 26 patients were included in the following comparative analysis. Sixteen patients who underwent surgery using the MCT technique were assigned to the MCT group; ten patients who underwent surgery using the TIP technique were assigned to the TIP group.

All patients had previously undergone repair by the TIP, two-stage, Duckett, or free foreskin graft urethroplasty procedures; the total number of previous operations ranged from 1 to 6. There were no statistically significant differences between the two groups in preoperative demographic characteristics (Table 1).

Intraoperative results
In the MCT group, ten patients utilized proximal rectangular flaps, while six patients utilized distal Y-shaped flaps; the mean tunnel length was 1.13 cm (s.d.: 0.58 cm, range: 0.5–3.0 cm). The mean operative time was longer in the MCT group (119.0 ± 36.1 min) than that in the TIP group (87.0 ± 36.1 min) \( (P = 0.04) \); blood loss (estimated by the surgeons) did not significantly differ between the MCT group (9.19 ± 6.21 ml) and the TIP group (8.50 ± 6.55 ml) \( (P = 0.79) \).

Postoperative complications and outcomes
In the MCT group, fifteen patients achieved a slit-like urethral meatus at the tip of the glans penis, as well as satisfactory penile appearance and voiding function (Figure 1f and 3e–3l). The MCT group exhibited a higher normal urethral meatus rate (15/16, 93.8%) and lower incidence of glans dehiscence (1/16, 6.2%), compared with the TIP group (70.0% and 30.0%, respectively); however, these differences were not statistically significant (both \( P = 0.26 \)). Mean postoperative HOPE scores were similar in the MCT group (8.83 ± 0.89) and the TIP group (8.94 ± 0.57) \( (P = 0.71) \); in the MCT group, the postoperative score was significantly higher than the preoperative score (6.53 ± 1.34) \( (P < 0.001) \). Additionally, no significant differences were found between the two groups with regard to the success rate, nor with respect to the complication rates of urethrocutaneous fistula, urethral stricture, glans dehiscence, wound infection, chordee, and LUTS (all \( P > 0.05 \); Table 2).

DISCUSSION
Patients with glans dehiscence after failed hypospadias repair who underwent surgery using the MCT technique achieved excellent cosmetic and functional outcomes in our study. Glans dehiscence leads to secondary hypospadias, which considerably affects penile appearance and voiding function; thus, it requires revision urethroplasty.\(^1\) However, repairing glans dehiscence after failed hypospadias repair is challenging for surgeons. In contrast to primary hypospadias, it is difficult to repair secondary hypospadias using the foreskin, because this tissue has been...
removed in most affected patients. Thus, Mathieu,\textsuperscript{5,14} TIP,\textsuperscript{12,15} two-stage,\textsuperscript{6} free skin graft, and mucosa urethroplasties\textsuperscript{15} are more practical in patients with failed hypospadias. Various technical modifications to improve outcomes have gradually been described with respect to the surgical repair of failed hypospadias; however, the total incidence of complications has remained high, especially concerning fistula and glans dehiscence.\textsuperscript{5,6,15} The cosmetic outcomes of failed hypospadias repair are inconsistent with patient expectations. Thus far, there is no superior method for glans dehiscence after failed hypospadias repair. However, in this study, patients who underwent surgery using the MCT technique achieved satisfactory penile appearance with a comparatively high HOPE score and adequate voiding function (Figure 3). Thus, we conclude that the MCT technique is suitable for repairing glans dehiscence after failed hypospadias repair.

The TIP technique was rapidly popularized by Snodgrass for its good cosmetic outcomes\textsuperscript{12} and has been widely applied in the repair of failed hypospadias.\textsuperscript{5,14} However, the high risk of glans dehiscence has limited the application of this technique in repairing glans dehiscence after failed hypospadias repair. A systematic review by Winberg \textit{et al.}\textsuperscript{16} revealed that the incidences of fistula in patients undergoing Mathieu and TIP urethroplasty procedures were both 13%; however, the incidence of urethral stricture was higher in the TIP group (5%) than that in the Mathieu technique group (2%). After TIP repair, Snodgrass \textit{et al.}\textsuperscript{12} reported that the incidence of glans dehiscence was up to 5%; another study of 500 patients demonstrated high rates of re-operation (18.6%) and glans dehiscence (6.4%).\textsuperscript{16} Glans dehiscence is associated with a small glans (<14 mm),\textsuperscript{19,20} a narrow and flat urethral plate, an oversized stent, wound infection, and improper repair technique. Especially with respect to the TIP technique, after urethral plate utilization and stent insertion, the glans incision exhibits high tension and can easily cause dehiscence. In this study, 14 of 26 patients had previously developed glans dehiscence following initial TIP repair. Scarring of the urethral plate and a lack of neourethral coverage tissues further limit application of the TIP technique in patients with failed hypospadias. Therefore, in this study, the MCT technique was used in 16 of 26 patients whose urethral plate was narrow and scarred. The TIP group seemed to exhibit higher incidence of glans dehiscence (30.0%), compared with the MCT group (6.2%). Notably, use of the
MCT technique led to superior appearance of the urethral meatus, compared with the TIP technique. Therefore, the TIP technique might not be the best option for patients with failed hypospadias.

The Mathieu technique provides a single-stage surgical option for failed hypospadias and has been frequently described as a salvage procedure.3,11,12,22 The distribution of skin tissues around the meatus considerably differs among patients with glans dehiscence; therefore, the classic flap does not allow sufficient urethralplasty in some patients. Additionally, the classic Mathieu technique can produce an abnormal urethral meatus (fish-mouth-like opening at the ventral side of the penis, rather than at the tip of the glans penis) with unsatisfactory penile appearance.3,9 Therefore, a series of modified Mathieu techniques have been proposed for use in patients with primary hypospadias, but not in patients with failed hypospadias.4,8,12–24

The MCT technique had three major technical modifications and advantages, compared with the classic Mathieu technique. First, the MCT technique adopted multiple custom-designed flaps; a proximal rectangular, distal rectangular, or distal Y-shaped flap was selected according to the concrete distribution of skin tissues around the meatus, which enriched the flap variety. Second, the tunnel technique was combined; a tunnel was constructed between the urethral meatus or coronary sulus and the tip of the glans, and the neourethra was passed through this tunnel, thereby avoiding incision in the glans penis. Third, the unique incision and flap design ensured that the neourethra suture line did not overlap with the skin suture line, presumably reducing the risk of fistula. These modifications are expected to solve the problem of insufficient material and avoid glans dehiscence for patients with failed hypospadias.25–30

CONCLUSIONS

The main MCT technical considerations were as follows. First, the proximal rectangular flap was preferred if available; this allowed the neourethra to be completely protected by the tunnel and provided a lower risk of fistula. Second, the flap was sufficient to surround the 6–10-Fr stent; harvesting a flap that was excessively wide would result in insufficient flap tissue to cover the urethra and close the incision. Third, tunnel initiation was ideally performed from the urethral meatus, far from the coronary sulcus (i.e., more than 5 mm), to reduce the risk of coronal fistula. Fourth, the tunnel was ideally near the tunica albuginea and in the middle of the glans penis to ensure sufficient depth, thus reducing the risk of glans dehiscence. Notably, one patient developed glans dehiscence because the tunnel was excessively shallow. Fifth, the tunnel diameter was approximately 5 mm to reduce the risks of urethral stricture and splitting of the glans penis. Sixth, following distal splitting of the glans, suturing of the slit was essential. Seventh, the TIP technique was recommended for patients with deep glanular grooves, whereas the MCT technique was not. If the MCT technique was applied to the patients with deep glanular grooves, these deep glanular grooves would remain obvious and affect the patient’s cosmetic appearance (Figure 3e); however, the shallow glanular groove would disappear and eventually a larger glans would be acquired upon application of the MCT technique.

The present study had some limitations. Notably, it was a single-center, retrospective, nonrandomized controlled study. Thus, a prospective randomized controlled study with a larger cohort is needed to evaluate this technique more comprehensively. However, this study provided a new technique for surgical management of failed hypospadias and it also improved the type of meatal-based flap available for use in the Mathieu technique. Moreover, it confirmed that the MCT technique exhibited an excellent therapeutic effect for patients with failed hypospadias; this effect was not inferior to the effect of the TIP technique. Another important limitation of this study was the small number of patients; this small sample size may have contributed to the absence of statistically significant differences between the two groups.

AUTHOR CONTRIBUTIONS

CHD and CS designed the study and edited the manuscript. QGX wrote the manuscript. KX and XPL edited the manuscript. ZQL contributed to data collection. PL supervised the study. All authors read and approved the final manuscript.

COMPETING INTERESTS

All authors declared no competing interests.

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REFERENCES

1. van der Horst HJ, de Wall LL. Hypospadias, all there is to know. Eur J Pediatr 2017; 176: 435–41.
2. Pohl HG, Rana S, Sprague BM, Beamer M, Rushion HG. Discrepant rates of hypospadias surgical complications: a comparison of U.S. News & World Report and Pediatric Health Information System® data and published literature. J Urol

Table 2: Comparison of postoperative complications and outcomes

| Complication or outcome | MCT (n=16) | TIP (n=10) | P |
|-------------------------|------------|------------|---|
| Urethrocutaneous fistula, n (%) | 2 (12.5) | 1 (10.0) | 1.0 |
| Urethral stricture, n (%) | 4 (25.0) | 2 (20.0) | 1.0 |
| Glans dehiscence, n (%) | 1 (6.2) | 3 (30.0) | 0.26 |
| Wound infection, n (%) | 2 (12.5) | 2 (20.0) | 0.63 |
| Normal urethral meatus, n (%) | 15 (93.8) | 7 (70.0) | 0.26 |
| Chordee, n (%) | 1 (6.2) | 1 (10.0) | 1.0 |
| LUTS, n (%) | 1 (6.2) | 1 (10.0) | 1.0 |
| Success, n (%) | 13 (81.2) | 6 (60.0) | 0.37 |
| HOPE score, mean±d. | 8.83±0.89 | 8.94±0.57 | 0.71 |

HOPE: Hypospadias Objective Penile Evaluation, total score=10 points; MCT: Mathieu combined tunnel; TIP: tubularized incised plate; LUTS: lower urinary tract symptoms; s.d.: standard deviation
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2020; 103: 616–23.
3 Gul M, Hildorf S, Silay MS. Sexual functions and fertility outcomes after hypospadias repair. Int J Impotence Res 2020; 33: 149–63.
4 Retik AB, Atala A. Complications of hypospadias repair. Urol Clin North Am 2002; 29: 329–39.
5 Turkylimaz Z, Karabulut R, Atan A, Sonmez K. Redo hypospadias repair: comparison of three different methods. Urol Int 2020; 104: 391–5.
6 Badawy H, Soliman A, Moussa A, Youssef M, Fahmy A, et al. Staged repair of redo and crippled hypospadias: analysis of outcomes and complications. J Pediatr Urol 2019; 15: 151.e1–10.
7 Mathieu P. Treatment of glanular and coronal hypospadias). J Chir 1932; 39: 481–6. [Article in French].
8 Hadidi AT. The slit-like adjusted Mathieu technique for distal hypospadias. J Pediatr Urol 2012; 47: 617–23.
9 Mansoor K, Tsang T, Okoro PE. Preservation of glanular cleft in the configuration of a vertical slit neomeatus in modified mathieu hypospadias repair. Afr J Paediatr Surg 2019; 16: 10–3.
10 Nozohoor Ekmark A, Svensson H, Arnbjörnsson E, Hansson E. Failed hypospadias repair: an algorithm for secondary reconstruction using remaining local tissue. J Plast Reconstr Aesthet Surg 2015; 68: 1600–9.
11 Karabulut A, Sunay M, Erdem K, Emir L, Erol D. Retrospective analysis of the results obtained by using Mathieu and TIP urethroplasty techniques in recurrent hypospadias repairs. J Pediatr Urol 2008; 4: 359–63.
12 Snodgrass WT. Tubularized incised plate (TIP) hypospadias repair. Urol Clin North Am 2002; 29: 285–90.
13 van der Toorn F, de Jong TP, de Gier RP, Callewaert PR, van der Horst EH, et al. Introducing the HOPE (Hypospadias Objective Penile Evaluation)-score: a validation study of an objective scoring system for evaluating cosmetic appearance in hypospadias patients. J Pediatr Urol 2013; 9: 1006–16.
14 Hayashi Y, Kojima Y, Mizuno K, Nakane A, Tozawa K, et al. Tubularized incised-plate urethroplasty for secondary hypospadias surgery. Int J Urol 2001; 8: 444–8.
15 Aldaqadossi HA, Shaker H, Youssef H, Kotb Y, Eladawy M. Outcomes of staged lingual mucosal graft urethroplasty for redo hypospadias repairs. J Pediatr Urol 2019; 15: 519.e511–7.
16 Winberg H, Arnbjörnsson E, Anderberg M, Stenström P. Postoperative outcomes in distal hypospadias: a meta-analysis of the Mathieu and tubularized incised plate repair methods for development of urethrococutaneous fistula and urethral stricture.

Pediatr Surg Int 2019; 35: 1301–8.
17 Snodgrass W, Cost N, Nakonezny PA, Bush N. Analysis of risk factors for glans dehiscence after tubularized incised plate hypospadias repair. J Urol 2011; 185: 1845–9.
18 Sarhan OM, El-Hefnawy AS, Hafez AT, Elsheribiny MT, Dawaba ME, et al. Factors affecting outcome of tubularized incised plate (TIP) urethroplasty: single-center experience with 500 cases. J Pediatr Urol 2009; 5: 378–82.
19 Bush NC, DaJusta D, Snodgrass WT. Glans penis width in patients with hypospadias compared to healthy controls. J Pediatr Urol 2013; 9: 1188–91.
20 Bush NC, Villanueva C, Snodgrass W. Glans size is an independent risk factor for urethroplasty complications after hypospadias repair. J Pediatr Urol 2015; 11: 355.e351–5.
21 Bar-Yosef Y, Binyamini J, Matzkin H, Ben-Chaim J. Salvage Mathieu urethroplasty: reuse of local tissue in failed hypospadias repair. Urology 2005; 65: 1212–5.
22 Emir L, Erol D. Mathieu urethroplasty as a salvage procedure: 20-year experience. J Urol 2003; 169: 2325–6.
23 De Grazia E, Cigna RM, Cimador M. Modified-Mathieu’s technique: a variation of the classic procedure for hypospadias surgical repair. Eur Uro Pediatr Surg 1998; 8: 98–9.
24 Nezami BG, Mahboubi AH, Tanhaievash R, Touichi A, Kajbafzadeh AM. Hypospadias repair and glans augmentation using a modified Mathieu technique. Pediatr Surg Int 2010; 26: 299–303.
25 Su C, Yang T, Zhang Z, Xu Y, Liang Q. Para-meatus skin incision with long channel technique for midshaft hypospadias repair without penile curvature. Urology 2012; 79: 1143–8.
26 Gecit I, Isik D, Pirincci N, Bilici S, Gunes M, et al. Kutlay technique for hypospadias repair. Int Urol Nephrol 2012; 44: 1311–8.
27 Yang T, Xie Q, Liang Q, Xu Y, Su C. Two-stage repair with long channel technique for primary severe hypospadias. Urol Int 2014; 84: 198–201.

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