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# Efficacy of preoperative manual detorsion for intravaginal testicular torsion: a systematic review

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# EFFICACY OF PREOPERATIVE MANUAL DETORSION FOR INTRAVAGINAL TESTICULAR TORSION: A SYSTEMATIC REVIEW

By

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# ABSTRACT

**Background**
Preoperative manual detorsion for acute testicular torsion has been postulated to improve testicular salvage rates through reduction in testicular ischemia time. Manual detorsion however has several potential risks including worsening degree of torsion, incomplete detorsion and potentially missing the opportunity to perform definitive orchidopexy.

**Objectives**
To assess the efficacy of preoperative manual detorsion compared to immediate scrotal exploration in improving testicular salvage in acute intravaginal testicular torsion.

**Methods**
The MEDLINE, SCOPUS and AJOL databases along with the CENTRAL registry were searched for trials comparing preoperative manual detorsion to immediate scrotal exploration for acute intravaginal testicular torsion. Both randomized and non-randomised trials of interventions were considered. Screening of abstracts, review of full text, extraction of data and risk of bias assessment were performed independently by two reviewers.

**Results**
Four retrospective cohort studies with 473 participants were included. Preoperative manual detorsion resulted in fewer orchidectomies compared to immediate scrotal exploration with a pooled risk ratio of 0.13 (95% CI 0.06 to 0.25, $P < 0.00001$). The overall certainty of the evidence was however downgraded to very low, predominantly due to elevated risk of bias in the included studies. Failure of manual detorsion and incomplete detorsion were noted across the included studies.

**Conclusion**
Preoperative manual detorsion may possibly increase testicular salvage rates amongst males presenting with testicular torsion. The reviewed data is however set in tertiary facilities and of very low certainty. Additionally, the risk of failure of detorsion and incomplete detorsion should always be kept in mind. Based on available data manual detorsion cannot be recommended for routine practice outside tertiary facilities. Future investigations should evaluate the utility of this intervention in varied settings, optimal endpoints and purpose to control for prognostic determinants of testicular salvage.

# LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| MD | - | Preoperative Manual Detorsion |
| ISE | - | Immediate Scrotal Exploration |
| NRSI | - | Non-Randomized Studies Of The Effects Of Interventions |
| RCT | - | Randomized Controlled Trial |
| ROBINS - I | - | Risk Of Bias In Non-randomized Studies - of Interventions |
| PRISMA | - | Preferred Reporting Items for Systematic Review and Meta-Analysis |
| AJOL | - | African Journals Online database |
| MEDLINE | - | National Library of Medicine's Bibliographic Database |
| GRADE | - | Grading of Recommendations, Assessment, Development and Evaluations |

## Review team

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Thank you all

# DECLARATION

*I declare this dissertation does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university and that to the best of my knowledge it does not contain any material previously published or written by another person except where due reference has been made in the text.*

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Signature of candidate

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31/05/2022

# TABLE OF CONTENTS

# LIST OF FIGURES

# LIST OF TABLES

# CHAPTER 1: BACKGROUND

Testicular torsion is a consequence of rotation of the spermatic cord along its longitudinal axis causing obstruction to blood flow resulting in testicular ischemia and eventual infarction of the affected testicle if perfusion is not re-established. It affects approximately 4.5 per 100,000 males under 25 years and is a leading cause of testicular loss (1). Immediate testicular loss at exploration averages 40% in large series and rates of long term sequalae such as testicular atrophy and sub–fertility in salvaged testes increase with increasing testicular ischemia time (2, 3). Timely intervention to re-perfuse the affected testis is key to preventing testicular loss and long-term testicular dysfunction (4, 5). Depending on the location of the twist two variants of testicular torsion are described, extra-vaginal and intravaginal.

Extravaginal testicular torsion results from a twist in the spermatic cord proximal to the tunica vaginalis. It occurs in the peri-neonatal period with the torsional event taking place either antenatally or in the early post-natal period and is identified at birth as a firm, discoloured, and nontender hemi-scrotal mass. Salvage rates for extra-vaginal testicular torsion have universally been dismal in view of late recognition (6). In addition to this, anaesthetic risks are high in the neonatal age group and scrotal exploration carries risk a of injury to the contralateral testis. The need for surgical intervention in extravaginal testicular torsion has therefore been questioned (7).

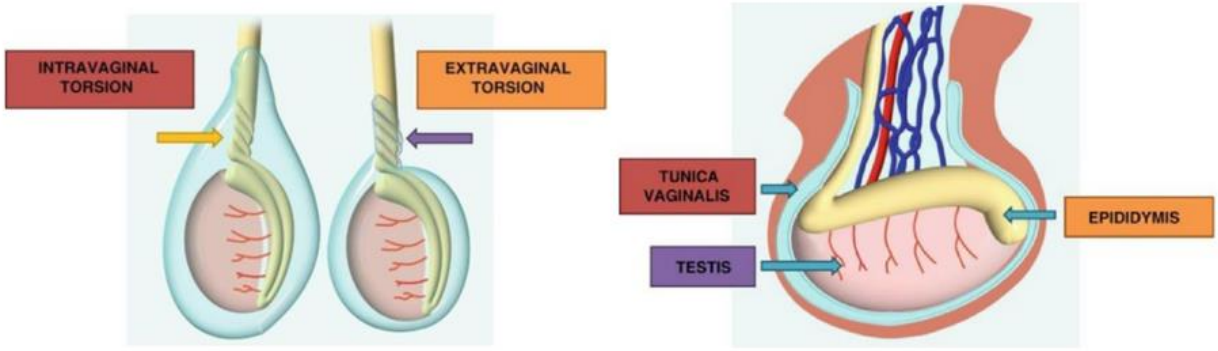


Figure 1: Extravaginal, intravaginal testicular torsion
Adapted from MacDonald (2020) (3)

Intravaginal testicular torsion results from twisting of the spermatic cord within the tunica vaginalis. The peripubertal age group is most affected presumably due to increasing testicular volume with the bell clapper deformity frequently identified as a predisposing anomaly (8). Testicular salvage is feasible and is largely dependent on time to detorsion (4). While prehospital delays contribute significantly to testicular loss (9) in-hospital delays have also been implicated (10). System quality improvements have led to reductions in time to diagnosis and transfer to the operating room however these time reductions have been modest and not translated to reduced orchidectomy rates (11, 12). This can be attributed to the fact that transfer to the operating room time, even though reduced, still adds to testicular ischemia time (13). Manual detorsion as a bridge to definitive scrotal exploration has therefore been put forward as a potential intervention to reduce in-hospital testicular ischemia time and possibly improve testicular salvage rates (14).

## Description of the intervention

Manual detorsion is principally aimed at reducing testicular ischemia time and is intended as a bridge to definitive scrotal exploration and orchidopexy. Professional society guidelines including the European paediatric urology guidelines support manual detorsion prior to definitive scrotal exploration (15). Individual reports have also demonstrated improved testicular salvage with manual detorsion (16, 17). The practice of manual detorsion however remains varied and manual detorsion being a blind procedure has been demonstrated to carry risk of worsening degree of torsion, incomplete detorsion, and missed opportunity for definitive fixation (14, 18).

Manual detorsion is performed with the patient supine and the operator positioned at the patient's side, left or right depending on handedness of the operator, or at the feet of the patient (19). The patient may be sedated (20) or have local anaesthetic testicular block (21). The European paediatric urology guidelines however favour the patient awake and sensate to facilitate feedback (15). Detorsion is achieved by grasping the affected testicle between thumb and index finger of the operator followed by an outward rotation (medial to lateral), akin to opening a book, of the testicle (Figure 2). Up to 33% of testicular torsions may however have an 'atypical' direction hence an outward / medial to lateral

turn may worsen the torsion (18). The degree of torsion may range from 360° to 1080°, therefore up to 3 complete turns may be required if anticipated endpoints are not met by a single turn.

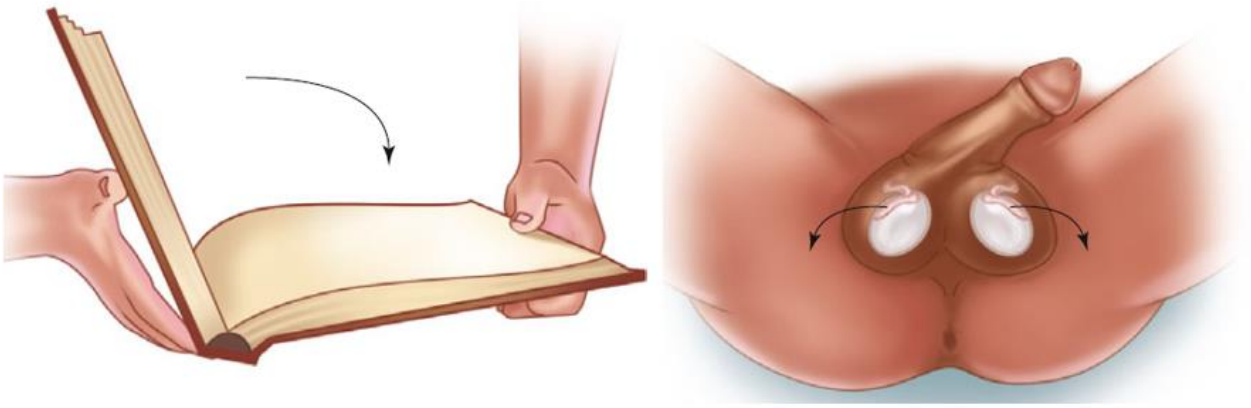

Figure 2: Detorsion is achieved by an outward rotation (medial to lateral) of the testes
Adapted from Allen and Nickels (19)

Success may be indicated by several endpoints including relief of pain, restoration of testicular position and vertical lie of the affected testicle. Partial relief of pain may indicate incomplete de-rotation and need for further outward rotation (22) Colour doppler ultrasonography has been advocated as an adjunct to guide direction of detorsion, confirm complete detorsion and restoration of blood flow (23).

Despite the concept of manual detorsion being in place since 1893 when first described by Nash, practice remains varied (24). The operator may be the attending surgeon or sonographer (25). The procedure may be performed with ultrasound guidance with the patient consciously sedated or having a testicular block. Following successful manual detorsion immediate scrotal exploration with orchidopexy is advised. However, practise is varied with some having scrotal exploration electively within the same admission or at a different admission. Some series describing patients declining surgery all together leaving them at risk of recurrent torsion (14). Varying time limitations to performance of manual detorsion have been described ranging from 6 to 24 hours from onset of pain (26). Features of overt testicular necrosis such as fixation to scrotum may however be more useful compared to a specific time cut off in deciding against performance of manual detorsion.

## How the intervention might work

Time to detorsion and reperfusion of the affected testis is the key determinant to salvage. Manual detorsion prior to definitive surgical exploration can reduce testicular ischemia time and improve salvage rates in testicular torsion. The current accepted standard of care is immediate surgical exploration with detorsion and orchidopexy. This however lends itself to pre-hospital delays where transfer to hospital with surgical capabilities is required and in-hospital delays in accessing the operating room. These delays prolong ischemia time potentially reducing testicular salvage rate and can be averted by manual detorsion.

## Justification - Why it is important to carry out this review?

Testicular torsion remains an important public health problem globally with testicular salvage rates remaining dismal particularly in settings with poor accessibility to emergency surgical services (27). Manual detorsion as a bridge to definitive surgery has been put forward as a potential solution (28). The procedure is however not without risk with potential for worsening torsion and incomplete detorsion (29, 30). The practice of manual detorsion is also variable with the impact of various adjuncts on the efficacy of the procedure unclear (31). A systematic review was therefore conducted to establish whether manual detorsion is efficacious in improving testicular salvage in acute intravaginal testicular torsion and to identify gaps in literature that may form the basis for future investigations.

## Review objective

To assess the efficacy of preoperative manual detorsion compared to immediate scrotal exploration in improving testicular salvage for acute intravaginal testicular torsion in males presenting within 24 hours of onset of scrotal pain.

# CHAPTER 2: METHODS

This systematic review was designed in keeping with the Cochrane handbook for systematic reviews of interventions (32). Details of the protocol for this systematic review were registered on PROSPERO and can be accessed at https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42022258113 (33).

## Criteria for considering studies for this review

### Types of studies

This review considered both randomised controlled trails and non-randomized studies of interventions (NRSI) comparing patients who underwent manual detorsion before scrotal exploration (intervention) to those having upfront scrotal exploration (comparator) for intravaginal testicular torsion. Non-randomised study designs considered eligible for inclusion were cohort studies and case-control studies, reporting both prospective and retrospective identification of participants and collection of data. Case reports and series that have no comparator group were excluded from this review.

There were no language restrictions. Where no English full text translations were available from the publishing journal the full texts were translated using Google translate services. Machine translated reports have been demonstrated to be valid and reduce language bias in systematic reviews (34).

### Types of Participants

Studies including males aged 2 years and older presenting with acute scrotal pain (less than 24 hours) and clinical or radiological findings consistent with acute intravaginal testicular torsion were included. Studies including patients with other causes of testicular pain were excluded. There was no restriction based on geographical location, setting or demographics.

## Types of interventions

Studies comparing manual detorsion prior to scrotal exploration (with or without use of adjuncts e.g., colour doppler ultrasound, sedation, spermatic cord block, parenteral analgesia) to immediate scrotal exploration for intravaginal testicular torsion were included. There was no restriction on medical personnel performing procedure (emergency medicine physician, paediatric surgeon, general surgeon, sonographer etc.).

## Types of outcome measures

### Primary outcome

The primary outcome for this review was testicular salvage. This was defined as successful restoration of testicular blood flow with resolution of pain and restoration of testicular lie.

### Secondary outcomes

Secondary outcomes assessed in this review included the following:

1. Incomplete detorsion.
   This was defined as intraoperative finding of spermatic cord torsion in previously assumed successful detorsion.
2. Failed detorsion.
   This was be defined by persistence of pain and abnormal physical examination findings necessitating immediate scrotal exploration.
3. Time to definitive orchidopexy.
   This was defined as time from successful manual detorsion to definitive surgery – orchidopexy.
4. Long term adverse outcomes
   The following long-term outcomes were recorded from included studies: testicular atrophy, chronic testicular pain, and sub – fertility.

## Search methods for identification of studies

The search strategy had no restriction on date of publication, status of publication or study design. Non – eligible study designs were excluded at either the title and abstract review stage or full text review stage if the title and abstract did not provide sufficient information.

### Electronic searches

Three databases - MEDLINE (PUBMED), SCOPUS and African Journals Online (AJOL) - and a register (Cochrane Central Register of Controlled Trials (CENTRAL)) were searched. The search strategy and final search dates for each database and register is outlined in Appendix 2.

### Searching other resources

The references in studies meeting the eligibility criteria were reviewed for additional candidate studies for inclusion. No grey literature searches were performed.

## Exclusion criteria

1. Studies that include patients aged 2 years or less, likely to include patients with extravaginal testicular torsion, were excluded.
2. Studies including patients with scrotal pain exceeding 24 hours.
3. Studies including patients with other causes of scrotal pain e.g. trauma, orchitis.
4. Case reports and series having no comparison of manual detorsion to immediate surgical exploration were excluded in analysis of the primary outcome.
5. Animal studies.

## Data collection

### Title and abstract screening

Search results from the databases and register were uploaded to Covidence software (Covidence systematic review software, Veritas Health Innovation, Melbourne, Australia. Available at www.covidence.org). Covidence performed automatic deduplication. The removed duplicates were reviewed before proceeding to title and abstract screening. De-duplicated titles and abstracts were screened for eligibility independently by two authors

(ROO and LJR), excluding those that do not meet eligibility criteria. Conflicts were addressed by consensus or tie breaking by a third member (JMM) of the review team.

### Full text review and data abstraction

Full text of eligible abstracts were reviewed on Covidence by two authors (ROO and LJR) independently and disagreements were resolved by a third author (JMM). A PRISMA flow diagram was generated to summarize the article selection process, detailing excluded studies and reasons of exclusion (35). A prespecified data collection tool (Appendix 1) was used to collect data items from eligible studies.

### Assessment of risk of bias in included studies

Included studies were appraised for risk of bias in the primary outcome independently by 2 authors (ROO and LJR). The RoB 2 tool would have been used for randomized controlled trials while the Risk Of Bias In Non-Randomized Studies - of Interventions (ROBINS-I) tool was used for non-randomized studies (36). A traffic light plot visualization of the domain-level judgements for each of the individual included studies was generated using Risk-of-bias VISualization (*robvis)* (37).

## Data analysis

Collected data was summarised in tables. Risk ratios with confidence intervals (C.I.) were calculated for the dichotomous primary outcome, testicular salvage vs testicular loss. A meta-analysis was performed using the fixed effects model analysis to arrive at a pooled risk ratio and presented as a Forest plot. Heterogeneity was assessed visually on the Forest plot and using both the $Chi^2$ test and the $I^2$ statistic. Cut offs were set at a P value of $< 0.10$ for the $Chi^2$ test and at 75% for the $I^2$ statistic. A sensitivity analysis was undertaken for studies excluded due to high risk of bias. Data were analysed using Review Manager 5.0 Review Manager (RevMan) Version 5.2. Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2012.

# CHAPTER 3: RESULTS

## Identification of studies via databases and registers

A total of 223 citations were identified using the search. No additional studies were identified through searching of manuscript references. Fifty-seven citations were de-duplicated following which 166 citations underwent title and abstract screening from which 132 citations were found ineligible. Thirty-four citations proceeded to full text screening from which 30 titles were excluded (Appendix 3). Wrong study design was the most common reason for excluding full text screened studies. Four manuscripts met the inclusion criteria and were included in the review and meta - analysis. The PRISMA flow chart (Figure 3) summaries the study selection process.

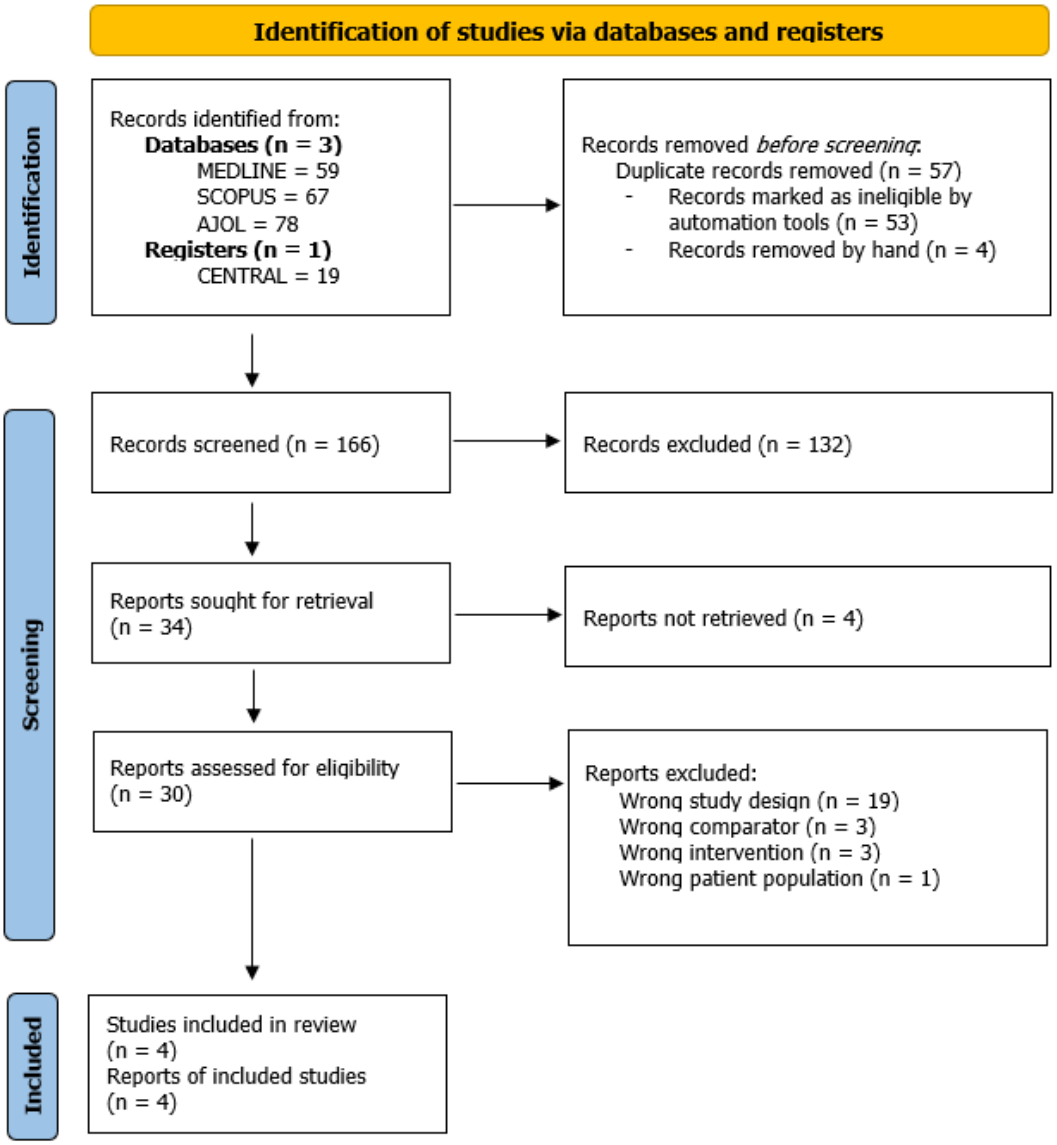


Figure 3: Preferred Reporting Items for Systematic Reviews and Meta-analyses flow chart

## Characteristics of the included studies

The included studies were all retrospective chart review cohort studies, set in tertiary facilities in high income countries. Cumulatively the included studies had a total of 473 males presenting with testicular torsion amongst whom 196 had preoperative manual detorsion and 277 had immediate scrotal exploration. The overall orchidectomy rate was 27.69% (131 testes), the highest orchidectomy rate in a single study was 62.5% and the lowest 12.78%. The participants in the included studies were predominantly in the adolescent age group. The study duration in the included studies ranged from 20 years to 3 years 9 months with only 2 studies reporting long term follow up data of salvaged testes at 8.25 and 8.9 months respectively, both under 1 year.

The degree of testicular torsion was elaborated in a single study, Sessions et al., where increased degree of rotation predicted orchidectomy, 540° (range 180 - 1080°) in the orchidectomy group compared to 360° (range 180 - 1080°) in the orchidopexy group. This was however not reported or controlled between those who had manual detorsion vs. immediate scrotal exploration. Duration of symptoms (presumed testicular ischemia time) was reported by 2 studies. Dias et al reported longer pre – intervention times in those getting immediate surgery while Vasconcelos et al had comparable duration of scrotal pain in both groups. Failure to control for and report on testicular ischemia time and degree of rotation resulted in severe risk of bias due to confounding and limited analysis of secondary outcomes.

The overall procedural description of manual detorsion in the included studies was deemed unclear and difficult to reproduce. All studies reported the practitioner performing manual detorsion being surgical specialist. The location of performing manual detorsion was reported by Dias Filho et al. and Vasconcelos-Castro et al. In both studies the emergency room was used. Dias Filho et al. specified no use of analgesia while Vasconcelos-Castro et al. used simple analgesia. Clinical examination and ultrasonography were used in the included studies to establish diagnosis of testicular torsion and success of manual detorsion, the specific findings were however not reported.

Table 1: Characteristics of the included studies

| | **Sessions et al. (18)** | **Dias Filho et al. (26)** | **Uguz 2016 et al. (38)** | **Vasconcelos-Castro 2020 et al. (39)** |
|---|---|---|---|---|
| **Year of publication** | 2003 | 2017 | 2016 | 2020 |
| **Country** | USA | Brazil | Turkey | Portugal |
| **Setting** | Tertiary hospital | Tertiary hospital | Tertiary hospital | Tertiary hospital |
| **Study design** | Retrospective cohort | Retrospective cohort | Retrospective cohort | Retrospective cohort |
| **Aim of study** | Primary objective was to investigate direction of rotation in testicular torsion | To determine whether manual detorsion is associated with improved surgical testicular salvage rates | Determining the rate of incidental testicular tumors in patients with testicular torsion | To evaluate the role of preoperative manual detorsion in the management of testicular torsion in a pediatric population |
| **Study Duration** | 20 years (1980 – 2000) | 3 years and 9 months (Jan 2012 – Sep 2015) | 12 years (Jan 2003 – Feb 2015) | 5 years (Jan 2014 – Dec 2018) |
| **Follow up time (Range)** | 8.25 months (1 to 39) | No follow-up specified | No follow-up specified | 8.9 months (0.2 to 51.8) |
| **Participants (% undergoing MD)** | 186 (30.12%) | 133 (57.14%) | 32 (18.75%) | 122 (47.54%) |
| **Age of participants** (Years) | 14 | 16.3* (14.4 - 19.3) | 21.1# (7 - 39) | 14.8* (13.3 - 16.1) |
| **Laterality** (% right) | 47.8 % | 56.4 % | 46.9 % | 55.7 % |
| **Testicular loss** | 37.63% | 12.78% | 62.5% | 14.75% |
| **Specialty of practitioner** | Paediatric urologist | Urologist | Urologist | Paediatric surgeon |
| **Ischemia time** (mean) | No information provided | MD - 6.6 hours<br>ISE - 6.3 hours | No information provided | MD - 5.0 (range 1 - 72) hours<br>ISE - 14.5 (range 1-192) hours |

**Key:**

*** - Median**
**# - Mean**
**MD – Manual detorsion**
**ISE – Immediate scrotal exploration**

## Risk of bias in included studies

Risk of bias for the primary outcome, testicular salvage, was assessed using the ROBINS – I tool. The article by Dias Filho et al. was judged to be at a moderate risk of bias while the article by Sessions et al. and Vasconcelos-Castro 2020 et al. were judged to be at serious risk of bias. Bias due to confounding contributed significantly to increasing risk of bias across studies with none of the included studies adequately controlling for testicular ischemia time or degree of rotation. The article by Uguz et al., was deemed to have a critical risk in the classification of interventions domain as it was unclear whether all participants had an attempt at preoperative manual detorsion thus lending it to high risk of misclassification of the intervention arm. Risk of bias for the included studies is summarized with domain level judgements for each study in the traffic light plot below (Figure 4).

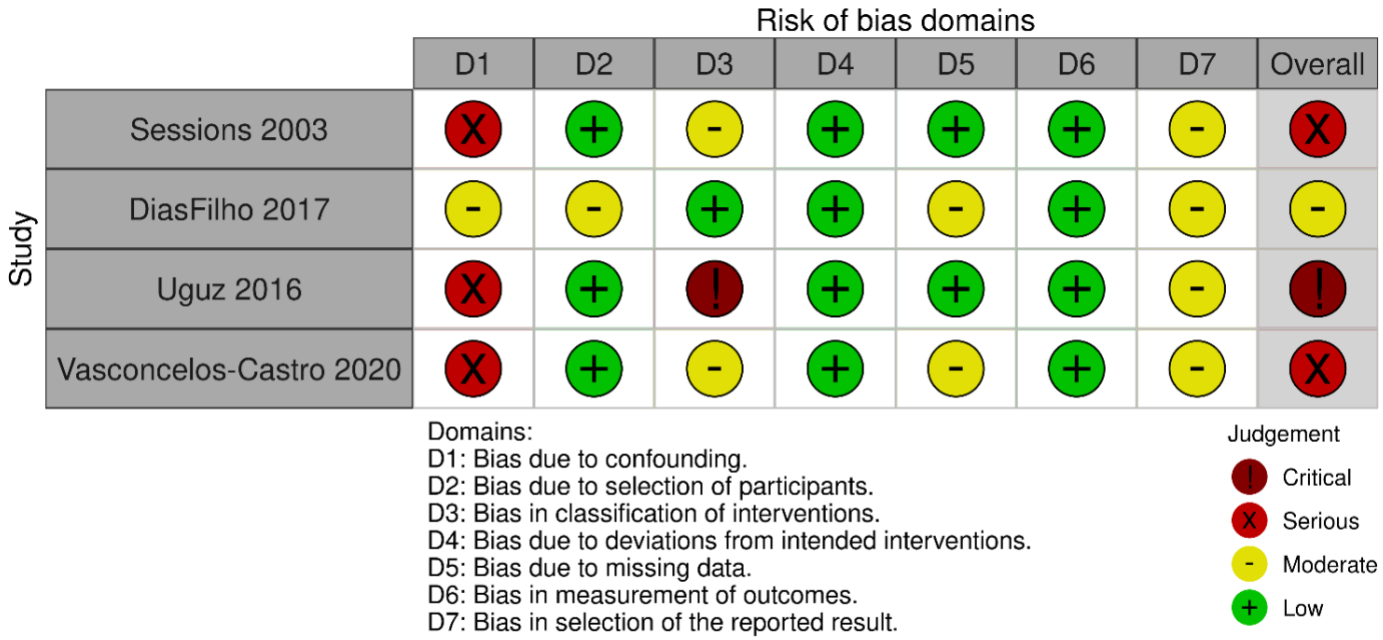


Figure 4: Traffic light plot with domain level judgements for each included study

**Primary outcome: Effect of preoperative manual detorsion on testicular salvage**

Preoperative manual detorsion resulted in fewer orchidectomies compared to immediate scrotal exploration with a pooled risk ratio of 0.13 (95% C.I. 0.06 to 0.25, P < 0.00001). The absolute risk for orchidectomy amongst males having preoperative manual detorsion was 5 per 100 while for those who had immediate surgery the absolute risk was 41 per 100. Three studies were included in the metanalysis to estimate the effect of preoperative manual detorsion on testicular salvage (18, 39, 40). The article by Uguz et al., was excluded due to critical risk of bias, a sensitivity analysis performed however demonstrated that the effect was maintained, risk ratio 0.12 (95% CI 0.06 to 0.24) (38). The forest plot, Figure 5, summarises the meta – analysis findings. There was moderate heterogeneity amongst the pooled studies ($Chi^2$ = 3.92, df = 2 (P = 0.14), $I^2$ = 49%). The overall certainty of evidence is downgraded to low due to high risk of bias in the pooled studies (summary of findings Table 2).

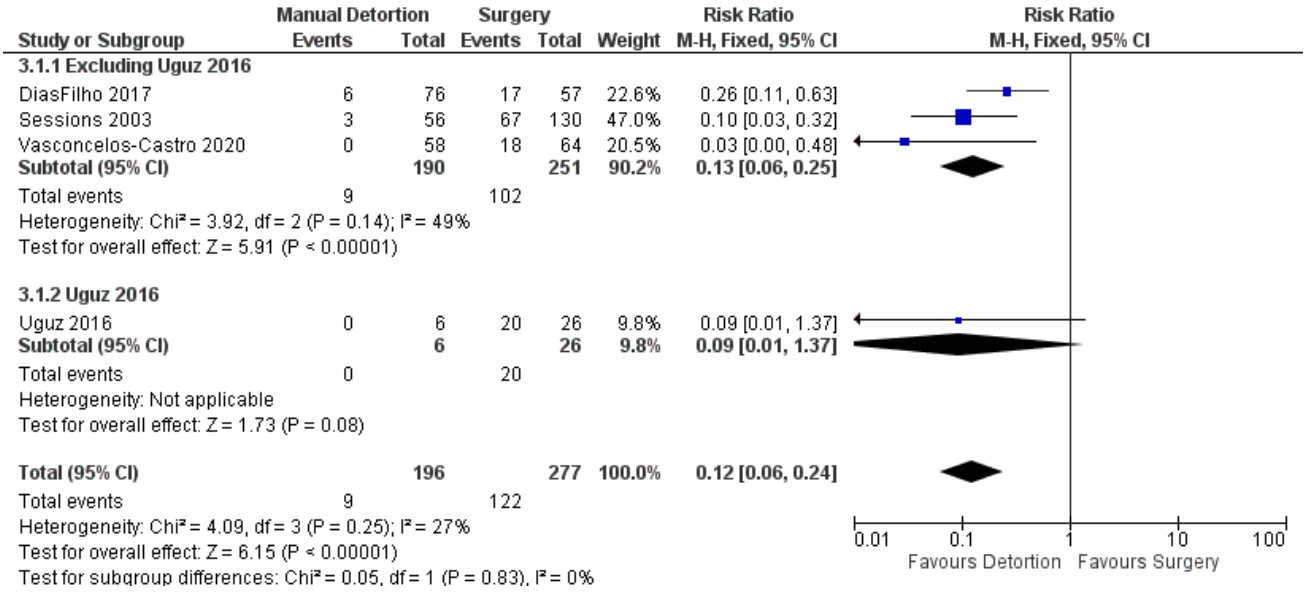


Figure 5: Forest plot summarising the meta - analysis findings and tests of heterogeneity

## Table 2 Summary of findings table

**Summary of findings:**

**Preoperative manual detorsion compared to immediate scrotal exploration for acute intravaginal testicular torsion**

**Patient or population:** Acute testicular pain due to intravaginal testicular torsion
**Intervention:** preoperative manual detorsion
**Comparison:** immediate scrotal exploration

| Outcomes | **Anticipated absolute effects*** (95% CI) | | Relative effect (95% CI) | Nº of participants (studies) | Certainty of the evidence (GRADE) | Comments |
|---|---|---|---|---|---|---|
| | **Risk with immediate scrotal exploration** | **Risk with preoperative manual detorsion** | | | | |
| Testicular loss (Orchidectomy) | 41 per 100 | **5 per 100** (2 to 10) | **RR 0.13** (0.06 to 0.25) | 441 (3 observational studies) | ⊕◯◯◯ Very low[a,b,c] | Preoperative manual detorsion probably results in a slight reduction in testicular loss. |

***The risk in the intervention group** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

**CI:** confidence interval; **RR:** risk ratio

**GRADE Working Group grades of evidence**
**High certainty:** we are very confident that the true effect lies close to that of the estimate of the effect.
**Moderate certainty:** we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
**Low certainty:** our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
**Very low certainty:** we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

*Explanations*
a. several risk of bias domains were judged as serious or critical risk of bias. This was principally from bias due to confounding, missing data and selection of the reported result
b. Grey literature was not exhaustively searched
c. Included studies predominantly small with only positive effect of intervention reported

## Secondary outcomes

Failure of manual detorsion and incomplete detorsion were reported by three of the four included studies with failure rates of 10.7%, 5% and 74%. Vasconcelos-Castro et al., had a high rate of failure of manual detorsion requiring emergency testicular exploration however none of these patients had an orchidectomy. Most of the failures of manual detorsion was noted to have incomplete detorsion intraoperatively. In addition, participants included in this study were mainly referrals potentially explaining difficulty in manual detorsion and resultant failure of detorsion.

All patients who had manual detorsion eventually had scrotal exploration and orchidopexy. Timing of orchidopexy was described as performed immediately following successful manual detorsion, within 24 hours of successful manual detorsion or electively within the same admission. Five participants from the Vasconcelos-Castros series had orchidopexy done electively at a different admission on average 10 days (3 to 21 days) after successful manual detorsion. They had no recurrence of symptoms. Incomplete detorsion noted intraoperatively following successful detorsion was noted in 32%, 26% and 3.4% of those who had manual detorsion. Two studies, Sessions et al. and Vasconcelos-Castro et al., reported long term follow-up data albeit both under 1 year of follow up. Vasconcelos-Castro et al., reported testicular atrophy among those having manual detorsion at 8.68% compared to 15.63% among those having immediate surgery.

Table 3 Secondary outcomes

| | **Sessions et al. (18)** | **Dias Filho et al. (40)** | **Uguz et al. (38)** | **Vasconcelos-Castro et al. (39)** |
|---|---|---|---|---|
| **Participants having MD** | 56 males | 76 males | 6 males | 58 males |
| **Failure of detorsion (%)** | 6<br>(10.7 %) | 4<br>(5.26%) | No information | 43<br>(74.14%) |
| **Time to orchidopexy**<br>**(Where MD successful)** | Electively within same admission | Immediately after successful detorsion | Immediately after successful detorsion | Within 24 hours of successful manual detorsion |
| **Incomplete detorsion**<br>**(% of participants having MD)** | 18<br>(32.14 %) | 20<br>(26.31 %) | No information | 2<br>(3.45%) |

# CHAPTER 4: DISCUSSION

The included studies were published between 2003 and 2020 hence represent a contemporary view of the application of manual detorsion. The overall orchidectomy rate in the pooled studies (27.69%) is similar to orchidectomy rates in other systematic reviews on testicular torsion. MacDonald et al., noted a cumulative testicular loss rate of 39% in a systematic review of 12 trials (3). The included studies may however not be representative of the testicular torsion population. These studies were set in high-income countries within tertiary facilities and predominantly had patients in the adolescent age group. Mugalo in a case series of 3 patients demonstrated the role of manual detorsion in poor resource settings with limited access to surgical services (28). Cabral Dias Filho et al. showed the benefit of pre-transfer manual detorsion in their cohort (41). Manual detorsion would therefore hypothetically have most impact in settings with limited access to surgical services and where a transfer to a referral hospital is necessary. Ramachandra et al. demonstrated the poorer testicular salvage rates among younger prepubescent males with testicular torsion and this age group been demonstrated to be distinct in testicular torsion outcomes (42, 43).

The meta-analysis of pooled risk ratios demonstrated an 87% reduction in the risk of testicular loss amongst those undergoing preoperative manual detorsion. The certainty of this large effect was however downgraded to very low predominantly due to the poor quality of the included studies along with elevated risk of bias in the included studies. The included studies were all observational studies with retrospective chart review data. No randomised studies were identified on this subject. Despite the included studies highlighting the importance of duration of testicular pain and degree of torsion, none of the studies controlled for these important confounders lending the studies to high risk of bias. All in all, preoperative manual detorsion probably results in a slight reduction in testicular loss amongst males with acute intra-vaginal testicular torsion.

As illustrated in the included studies practitioners attempting preoperative manual detorsion must always be prepared for failure of manual detorsion and plan for emergent exploration. Risk stratifying patients presenting with testicular torsion to identify those at risk of failure of manual detorsion will greatly enhance the safety of preoperative manual

detorsion by avoiding a potentially obsolete time-consuming manoeuvrer. If manual detorsion is successful scrotal exploration remains imperative. Scrotal exploration not only provides definitive fixation of the testicle but also allows for completion of detorsion where incomplete detorsion is present. The timing of manual detorsion was varied in the included studies however all patients eventually had orchidopexy. Post manual detorsion ultrasonography was utilised in all the included studies and may play a key role in stratifying urgency of exploration following successful manual detorsion. Hosokawa et al. demonstrated the utility of the ultrasonographic whirlpool sign in detecting residual torsion in their 13 case radiological case series hence aiding in deciding on urgency of exploration (44). Ultrasonographic demonstration of segmental hypoperfusion with peripheral hyper - perfusion may be a predictor of testicular compartment syndrome in successfully detorsion testes (45). Decompression of testicular compartment syndrome through tunica albuginea incision with or without tunica vaginalis flap has demonstrated promising results in improving testicular salvage (46).

We conducted this review in keeping with best practice recommendation from the Cochrane collaboration handbook on systematic reviews of interventions and the reporting of the protocol and final review followed recommendations from PRISMA (32, 35). The systematic review protocol was registered in PROSPERO and any deviations from the protocol have been noted. The search was not limited by date, status of publication or language ensuring comprehensive search of the published literature. Despite extensive search four full text titles were not retrieved. Preoperative manual detorsion has been advocated for in low resource settings where access to surgical services is limited. Despite searching through 3 databases and a comprehensive registry including a dedicated African health sciences database no relevant studies from low-income settings were found.

# CHAPTER 5: CONCLUSION

Scrotal exploration with orchidopexy remains the definitive treatment for testicular torsion. Preoperative manual detorsion may nonetheless increase testicular salvage rates amongst males presenting with acute testicular torsion. This must however be put in context of the pooled evidence. The included studies were conducted in tertiary centres with highly trained surgical specialists. Additionally, the studies had significant risk of bias significantly reducing certainty of the efficacy of preoperative manual detorsion in increasing testicular salvage rates. Significantly, incomplete detorsion rates were noted in all the included studies highlighting the importance of post-procedural ultrasonography or expedited scrotal exploration. Based on available published data preoperative manual detorsion cannot be recommended for routine practice outside well-staffed and equipped tertiary hospitals.

# CHAPTER 6: RECOMMENDATIONS

Future study into the role of preoperative manual detorsion should ensure control of prognostic confounders possibly through case matched controls for duration of symptoms and degree of rotation. In addition, predictors for failure of manual detorsion should be developed along with robust end points of manual detorsion to reduce the risk of incomplete detorsion hence maintaining safety of the intervention. The current review supports this management strategy in tertiary facilities with specialised healthcare providers and in the adolescent age group. Further study into use of preoperative manual detorsion in the community and low-income settings and among the preadolescent age group will be required.

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# APPENDICES

## Appendix 1: Data Collection tool

**General Information**

| | | Location in text (page/fig/table/other) |
|---|---|---|
| Study ID | | |
| Study title | | |
| Lead author (corresponding author) | | |
| Contact details of corresponding author | | |
| Year of publication | | |
| Time period of study (Period of data collection) | | |
| In which country was this trial conducted? | | |
| What level of hospital was this study conducted in? | Tertiary/ Referral / Teaching facility, Community Hospital | |
| Notes: | | |

**Characteristics of included studies**
**Methods**

| | | | Location in text (Page, fig/table/other) |
|---|---|---|---|
| Study design | Randomized control trial<br><br>Non - randomized trial design<br>o Cohort study<br>o Case control trial<br>o Quasi – Randomized | Specify if data collected prospectively or retrospectively | |
| Patient selection | 1. Judgement of attending physician during routine clinical practice<br>2. Systemic sampling<br>3. Cluster sampling<br>4. Stratified sampling<br>5. Simple random sapling<br>6. Other - Specify | | |
| Total number of participants | | | |
| Median age in Years (IQR) | | | |
| Confounders | Did the trial control for the following confounding factors:<br>1. Did this trial control for patients transferred from a different facility?<br>Yes/ No / Not Specified<br><br>2. Did this trial control for duration of scrotal pain?<br>Yes/ No / Not Specified<br><br>3. Did this trial control for degree of torsion (Number of twists)?<br>Yes/ No / Not Specified<br><br>4. Did this trial control for direction of twist (Medial to lateral Vs. Lateral to medial twist)?<br>Yes/ No / Not Specified<br><br>5. Did the trial authors specify any other confounders which they identified and controlled for?<br>Yes/ No / Not Specified | | |

**Participants**

| | | Location in text (Page, fig/table/other) |
|---|---|---|
| Population description (What population was studied?) | | |
| Inclusion criteria (What inclusion criteria do the authors specify?) | | |
| Exclusion criteria (What criteria were used to exclude patients from this study?) | | |
| Diagnostic criteria How was diagnosis of testicular torsion made? | ○ Clinical examination only<br>○ Clinical examination and ultrasonography<br>○ Scintigraphy<br>○ No information<br>○ Other - Specify | |

**Baseline population characteristics**

| | Manual detorsion | Immediate scrotal exploration | Overall |
|---|---|---|---|
| Number of Participants | | | |
| Median Age in Years (IQR) | | | |
| Ischemia time | | | |
| In Hospital ischemia time | | | |
| Degree of torsion | | | |
| Medial direction of torsion | | | |
| Lateral direction of torsion | | | |

**Laterality**

| | Right | Left | Bilateral | Total |
|---|---|---|---|---|
| Manual detorsion | | | | |
| Immediate scrotal exploration | | | | |
| Total | | | | |

## Intervention – Manual detorsion

| | | Location in text (Page, fig/table/other) |
|---|---|---|
| **Description of Manual detorsion** | | |
| Have the authors stated indications for Manual detorsion? | Y / N<br>If Y – Specify the authors indications for MD | |
| Have the authors stated the contraindications for Manual Detorsion? | Y / N<br>If Y – Specify the authors indication for MD | |
| What specialty of practitioner performed MD? | General Surgeon, Urologist, Paed. Surgeon, Paed. Urologist, Emergency medicine, family medicine, General practitioner, sonographer, Other (specify), No information | |
| Was scrotal exploration performed by the same physician performing MD? | If No Specify<br>General Surgeon, Urologist, Paed. Surgeon, Paed. Urologist, sonographer, family medicine Resident trainee, Other (specify), No information | |
| Where was MD performed? | 1. Emergency room<br>2. Ultrasound suite<br>3. Preoperative area<br>4. Other (specify)<br>No Information | |
| Pain management | 1. Simple analgesia – (paracetamol, NSAID, weak opioid)<br>2. Testicular block<br>3. Pain control with conscious sedation<br>4. Ultrasound guidance to confirm reperfusion<br>5. Other - specify | |
| What was the end point of manual detorsion and how was testicular reperfusion ascertained? | Resolution of pain,<br>Restoration of testicular lie<br>Ultrasonography documentation of perfusion<br>Other - Specify | |
| Have the authors provided an overall reproducible description of how they perform MD? | Yes - Detailed reproducible description<br>Unclear – Description provided but not clear or reproducible<br>No – No description of MD provided | |

**Outcome following manual detorsion**
**Testicular salvage**

| | Manual detorsion | Immediate scrotal exploration | Overall |
|---|---|---|---|
| Testicular salvage - Orchidopexy | | | |
| Testicular loss - Orchidectomy | | | |
| Total | | | |

How many participants had Failed manual detorsion?
*(Failed detorsion - Persistent pain / abnormal physical examination findings necessitation urgent progression to scrotal exploration)*

How many patients had incomplete manual detorsion?
*(Intraoperative or radiologic finding of residual spermatic cord torsion despite presumed successful detorsion e.g pain resolved)*

**Timing to definitive fixation**

| | Number |
|---|---|
| Immediately following manual detorsion | |
| Electively within same admission | |
| Electively at a different admission | |
| Definitive scrotal exploration and orchidopexy not done | |

How many patients did not have definitive scrotal exploration following MD?
*Indicate reasons provided.*

**Long term outcomes**

| | Manual detorsion | Immediate scrotal exploration | Overall |
|---|---|---|---|
| Testicular atrophy | | | |
| Chronic testicular pain | | | |
| Sub – fertility / infertility | | | |
| Total | | | |

# Appendix 2: Search strategies

## MEDLINE (via PUBMED) search strategy – 31st March 2022

**#1**

**((((((((((((((("Spermatic Cord Torsion"[Mesh]) OR ("Spermatic Cord Torsions")) OR ("Spermatic Cord Torsion")) OR (Spermatic cord torsion)) OR ("Torsion of Testicular Cord")) OR (Testicular cord torsion)) OR ("Testicular cord torsion")) OR ("Testicular Torsion")) OR ("Testicular Torsions")) OR (Testicular twisting)) OR ("spermatic cord twisting")) OR ("testis torsion")) OR (testes torsion)) OR ("testicle torsion")) OR ("Testicular infarction")) OR (Spermatic cord ischemia)) OR (Spermatic cord ischaemia)) OR (Testicular cord ischemia)) OR (Testicular cord ischaemia)** **4,117 results**

"Spermatic Cord Torsion"[MeSH Terms] OR "Spermatic Cord Torsions"[All Fields] OR "Spermatic Cord Torsion"[All Fields] OR ("Spermatic Cord Torsion"[MeSH Terms] OR ("spermatic"[All Fields] AND "cord"[All Fields] AND "torsion"[All Fields]) OR "Spermatic Cord Torsion"[All Fields]) OR "Torsion of Testicular Cord"[All Fields] OR (("spermatic cord"[MeSH Terms] OR ("spermatic"[All Fields] AND "cord"[All Fields]) OR "spermatic cord"[All Fields] OR ("Testicular"[All Fields] AND "cord"[All Fields]) OR "testicular cord"[All Fields]) AND ("torsion"[All Fields] OR "torsional"[All Fields] OR "torsionally"[All Fields] OR "torsioned"[All Fields] OR "torsions"[All Fields])) OR "Testicular cord torsion"[All Fields] OR "Testicular Torsion"[All Fields] OR "Testicular Torsions"[All Fields] OR ("Testicular"[All Fields] AND ("twist"[All Fields] OR "twisted"[All Fields] OR "twisting"[All Fields] OR "twists"[All Fields])) OR "spermatic cord twisting"[All Fields] OR "testis torsion"[All Fields] OR (("teste"[All Fields] OR "testi"[All Fields] OR "testis"[MeSH Terms] OR "testis"[All Fields] OR "testes"[All Fields] OR "inferior colliculi"[MeSH Terms] OR ("inferior"[All Fields] AND "colliculi"[All Fields]) OR "inferior colliculi"[All Fields]) AND ("torsion"[All Fields] OR "torsional"[All Fields] OR "torsionally"[All Fields] OR "torsioned"[All Fields] OR "torsions"[All Fields])) OR "testicle torsion"[All Fields] OR "Testicular infarction"[All Fields] OR (("spermatic cord"[MeSH Terms] OR ("spermatic"[All Fields] AND "cord"[All Fields]) OR "spermatic cord"[All Fields]) AND ("ischaemia"[All Fields] OR "ischemia"[MeSH Terms] OR "ischemia"[All Fields] OR "ischaemias"[All Fields] OR "ischemias"[All Fields])) OR (("spermatic cord"[MeSH Terms] OR ("spermatic"[All Fields] AND "cord"[All Fields]) OR "spermatic cord"[All Fields]) AND ("ischaemia"[All Fields] OR "ischemia"[MeSH Terms] OR "ischemia"[All Fields] OR "ischaemias"[All Fields] OR "ischemias"[All Fields])) OR (("spermatic cord"[MeSH Terms] OR ("spermatic"[All Fields] AND "cord"[All Fields]) OR "spermatic cord"[All Fields] OR ("Testicular"[All Fields] AND "cord"[All Fields]) OR "testicular cord"[All Fields]) AND ("ischaemia"[All Fields] OR "ischemia"[MeSH Terms] OR "ischemia"[All Fields] OR "ischaemias"[All Fields] OR "ischemias"[All Fields])) OR (("spermatic cord"[MeSH Terms] OR ("spermatic"[All Fields] AND "cord"[All Fields]) OR "spermatic cord"[All Fields] OR ("Testicular"[All Fields] AND "cord"[All Fields]) OR "testicular cord"[All Fields]) AND ("ischaemia"[All Fields] OR "ischemia"[MeSH Terms] OR "ischemia"[All Fields] OR "ischaemias"[All Fields] OR "ischemias"[All Fields])) = 59

**#2**

**((((((((((("Manual detorsion") OR (Manual de-torsion)) OR ("Manual derotation")) OR (Manual de-rotation)) OR (manual untwist)) OR ("Manual reduction")) OR (manual salvage)) OR ("Manipulative detorsion")) OR (Manipulative de-torsion)) OR ("Manual manipulation")) OR ("Elastic retraction method")) OR ("Push and turn method")) OR ("push-and-turn method")** **= 1187 results**

"Manual detorsion"[All Fields] OR (("manual s"[All Fields] OR "manualization"[All Fields] OR "manualized"[All Fields] OR "manually"[All Fields] OR "manuals as topic"[MeSH Terms] OR ("manuals"[All Fields] AND "topic"[All Fields]) OR "manuals as topic"[All Fields] OR "manual"[All Fields] OR "manuals"[All Fields]) AND "de-torsion"[All Fields]) OR "Manual derotation"[All Fields] OR (("manual s"[All Fields] OR "manualization"[All Fields] OR "manualized"[All Fields] OR "manually"[All Fields] OR "manuals as topic"[MeSH Terms] OR ("manuals"[All Fields] AND "topic"[All Fields]) OR "manuals as topic"[All Fields] OR "manual"[All Fields] OR "manuals"[All Fields]) AND "de-rotation"[All Fields]) OR (("manual s"[All Fields] OR

"manualization"[All Fields] OR "manualized"[All Fields] OR "manually"[All Fields] OR "manuals as topic"[MeSH Terms] OR ("manuals"[All Fields] AND "topic"[All Fields]) OR "manuals as topic"[All Fields] OR "manual"[All Fields] OR "manuals"[All Fields]) AND ("untwist"[All Fields] OR "untwisted"[All Fields] OR "untwisting"[All Fields] OR "untwists"[All Fields])) OR "Manual reduction"[All Fields] OR (("manual s"[All Fields] OR "manualization"[All Fields] OR "manualized"[All Fields] OR "manually"[All Fields] OR "manuals as topic"[MeSH Terms] OR ("manuals"[All Fields] AND "topic"[All Fields]) OR "manuals as topic"[All Fields] OR "manual"[All Fields] OR "manuals"[All Fields]) AND ("salvage therapy"[MeSH Terms] OR ("salvage"[All Fields] AND "therapy"[All Fields]) OR "salvage therapy"[All Fields] OR "salvage"[All Fields] OR "salvageability"[All Fields] OR "salvageable"[All Fields] OR "salvaged"[All Fields] OR "salvages"[All Fields] OR "salvaging"[All Fields])) OR "Manipulative detorsion"[All Fields] OR (("manipulative"[All Fields] OR "manipulatives"[All Fields]) AND "de-torsion"[All Fields]) OR "Manual manipulation"[All Fields] OR "Elastic retraction method"[All Fields] OR "push and turn method"[All Fields] OR "push and turn method"[All Fields]

#1 AND #2

**((((((((((((((((("Spermatic Cord Torsion"[Mesh]) OR ("Spermatic Cord Torsions")) OR ("Spermatic Cord Torsion")) OR (Spermatic cord torsion)) OR ("Torsion of Testicular Cord")) OR (Testicular cord torsion)) OR ("Testicular cord torsion")) OR ("Testicular Torsion")) OR ("Testicular Torsions")) OR (Testicular twisting)) OR ("spermatic cord twisting")) OR ("testis torsion")) OR (testes torsion)) OR ("testicle torsion")) OR ("Testicular infarction")) OR (Spermatic cord ischemia)) OR (Spermatic cord ischaemia)) OR (Testicular cord ischemia)) OR (Testicular cord ischaemia)) AND ((((((((((("Manual detorsion") OR (Manual de-torsion)) OR ("Manual derotation")) OR (Manual de-rotation)) OR (manual untwist)) OR ("Manual reduction")) OR (manual salvage)) OR ("Manipulative detorsion")) OR (Manipulative de-torsion)) OR ("Manual manipulation")) OR ("Elastic retraction method")) OR ("Push and turn method")) OR ("push-and-turn method")) = 59 results**

("Spermatic Cord Torsion"[MeSH Terms] OR "Spermatic Cord Torsions"[All Fields] OR "Spermatic Cord Torsion"[All Fields] OR ("Spermatic Cord Torsion"[MeSH Terms] OR ("spermatic"[All Fields] AND "cord"[All Fields] AND "torsion"[All Fields]) OR "Spermatic Cord Torsion"[All Fields]) OR "Torsion of Testicular Cord"[All Fields] OR (("spermatic cord"[MeSH Terms] OR ("spermatic"[All Fields] AND "cord"[All Fields]) OR "spermatic cord"[All Fields] OR ("Testicular"[All Fields] AND "cord"[All Fields]) OR "testicular cord"[All Fields]) AND ("torsion"[All Fields] OR "torsional"[All Fields] OR "torsionally"[All Fields] OR "torsioned"[All Fields] OR "torsions"[All Fields])) OR "Testicular cord torsion"[All Fields] OR "Testicular Torsion"[All Fields] OR "Testicular Torsions"[All Fields] OR ("Testicular"[All Fields] AND ("twist"[All Fields] OR "twisted"[All Fields] OR "twisting"[All Fields] OR "twists"[All Fields])) OR "spermatic cord twisting"[All Fields] OR "testis torsion"[All Fields] OR (("teste"[All Fields] OR "testi"[All Fields] OR "testis"[MeSH Terms] OR "testis"[All Fields] OR "testes"[All Fields] OR "inferior colliculi"[MeSH Terms] OR ("inferior"[All Fields] AND "colliculi"[All Fields]) OR "inferior colliculi"[All Fields]) AND ("torsion"[All Fields] OR "torsional"[All Fields] OR "torsionally"[All Fields] OR "torsioned"[All Fields] OR "torsions"[All Fields])) OR "testicle torsion"[All Fields] OR "Testicular infarction"[All Fields] OR (("spermatic cord"[MeSH Terms] OR ("spermatic"[All Fields] AND "cord"[All Fields]) OR "spermatic cord"[All Fields]) AND ("ischaemia"[All Fields] OR "ischemia"[MeSH Terms] OR "ischemia"[All Fields] OR "ischaemias"[All Fields] OR "ischemias"[All Fields])) OR (("spermatic cord"[MeSH Terms] OR ("spermatic"[All Fields] AND "cord"[All Fields]) OR "spermatic cord"[All Fields]) AND ("ischaemia"[All Fields] OR "ischemia"[MeSH Terms] OR "ischemia"[All Fields] OR "ischaemias"[All Fields] OR "ischemias"[All Fields])) OR (("spermatic cord"[MeSH Terms] OR ("spermatic"[All Fields] AND "cord"[All Fields]) OR "spermatic cord"[All Fields] OR ("Testicular"[All Fields] AND "cord"[All Fields]) OR "testicular cord"[All Fields]) AND ("ischaemia"[All Fields] OR "ischemia"[MeSH Terms] OR "ischemia"[All Fields] OR "ischaemias"[All Fields] OR "ischemias"[All Fields])) OR (("spermatic cord"[MeSH Terms] OR ("spermatic"[All Fields] AND "cord"[All Fields]) OR "spermatic cord"[All Fields] OR ("Testicular"[All Fields] AND "cord"[All Fields]) OR "testicular cord"[All Fields]) AND ("ischaemia"[All Fields] OR "ischemia"[MeSH Terms] OR "ischemia"[All Fields] OR "ischaemias"[All Fields] OR "ischemias"[All Fields]))) AND ("Manual detorsion"[All Fields] OR (("manual s"[All Fields] OR "manualization"[All Fields] OR "manualized"[All Fields] OR "manually"[All Fields] OR "manuals as topic"[MeSH Terms] OR ("manuals"[All Fields] AND "topic"[All Fields]) OR "manuals as topic"[All Fields] OR "manual"[All Fields] OR "manuals"[All Fields]) AND "de-torsion"[All Fields]) OR "Manual derotation"[All Fields] OR (("manual s"[All Fields] OR "manualization"[All

Fields] OR "manualized"[All Fields] OR "manually"[All Fields] OR "manuals as topic"[MeSH Terms] OR ("manuals"[All Fields] AND "topic"[All Fields]) OR "manuals as topic"[All Fields] OR "manual"[All Fields] OR "manuals"[All Fields]) AND "de-rotation"[All Fields]) OR (("manual s"[All Fields] OR "manualization"[All Fields] OR "manualized"[All Fields] OR "manually"[All Fields] OR "manuals as topic"[MeSH Terms] OR ("manuals"[All Fields] AND "topic"[All Fields]) OR "manuals as topic"[All Fields] OR "manual"[All Fields] OR "manuals"[All Fields]) AND ("untwist"[All Fields] OR "untwisted"[All Fields] OR "untwisting"[All Fields] OR "untwists"[All Fields])) OR "Manual reduction"[All Fields] OR (("manual s"[All Fields] OR "manualization"[All Fields] OR "manualized"[All Fields] OR "manually"[All Fields] OR "manuals as topic"[MeSH Terms] OR ("manuals"[All Fields] AND "topic"[All Fields]) OR "manuals as topic"[All Fields] OR "manual"[All Fields] OR "manuals"[All Fields]) AND ("salvage therapy"[MeSH Terms] OR ("salvage"[All Fields] AND "therapy"[All Fields]) OR "salvage therapy"[All Fields] OR "salvage"[All Fields] OR "salvageability"[All Fields] OR "salvageable"[All Fields] OR "salvaged"[All Fields] OR "salvages"[All Fields] OR "salvaging"[All Fields])) OR "Manipulative detorsion"[All Fields] OR (("manipulative"[All Fields] OR "manipulatives"[All Fields]) AND "de-torsion"[All Fields]) OR "Manual manipulation"[All Fields] OR "Elastic retraction method"[All Fields] OR "push and turn method"[All Fields] OR "push and turn method"[All Fields])

## SCOPUS search strategy – 14th April 2022

#1

5,172 document results

( TITLE-ABS-KEY ( "spermatic cord torsion" ) OR TITLE-ABS-KEY ( spermatic AND cord AND torsion ) OR TITLE-ABS-KEY ( "Torsion of Testicular cord" ) OR TITLE-ABS-KEY ( torsion AND of AND testicular AND cord ) OR TITLE-ABS-KEY ( "Testicular cord torsion" ) OR TITLE-ABS-KEY ( testicular AND cord AND torsion ) OR TITLE-ABS-KEY ( testicular AND twisting ) OR TITLE-ABS-KEY ( "spermatic cord twisting" ) OR TITLE-ABS-KEY ( test?s AND torsion ) OR TITLE-ABS-KEY ( {testicle torsion} ) OR TITLE-ABS-KEY ( {Testicular infarction} ) OR TITLE-ABS-KEY ( "Spermatic cord ischemia" ) OR TITLE-ABS-KEY ( "Spermatic cord ischaemia" ) OR TITLE-ABS-KEY ( "Testicular cord ischemia" ) OR TITLE-ABS-KEY ( "Testicular cord ischaemia" ) )

#2

1,819 document results

( TITLE-ABS-KEY ( "manual detorsion" ) OR TITLE-ABS-KEY ( {manual detorsion} ) OR TITLE-ABS-KEY ( "manual derotation" ) OR TITLE-ABS-KEY ( {manual derotation} ) OR TITLE-ABS-KEY ( manual AND untwist ) OR TITLE-ABS-KEY ( "manual reduction" ) OR TITLE-ABS-KEY ( {manual reduction} ) OR TITLE-ABS-KEY ( manual AND salvage ) OR TITLE-ABS-KEY ( "manipulative detorsion" ) OR TITLE-ABS-KEY ( {manipulative detorsion} ) OR TITLE-ABS-KEY ( "manual manipulation" ) OR TITLE-ABS-KEY ( {manual manipulation} ) OR TITLE-ABS-KEY ( "Elastic retraction method" ) OR TITLE-ABS-KEY ( {Elastic retraction method} ) OR TITLE-ABS-KEY ( "Push and turn method" ) OR TITLE-ABS-KEY ( {Push and turn method} ) )

#3

1,819 document results

( TITLE-ABS-KEY ( "manual detorsion" ) OR TITLE-ABS-KEY ( "manual derotation" ) OR TITLE-ABS-KEY ( manual AND untwist ) OR TITLE-ABS-KEY ( "manual reduction" ) OR TITLE-ABS-KEY ( manual AND salvage ) OR TITLE-ABS-KEY ( "manipulative detorsion" ) OR TITLE-ABS-KEY ( "manual manipulation" ) OR TITLE-ABS-KEY ( "Elastic retraction method" ) OR TITLE-ABS-KEY ( "Push and turn method" ) )

#1 AND #2 = 67

67 document results

( ( TITLE-ABS-KEY ( "spermatic cord torsion" ) OR TITLE-ABS-KEY ( spermatic AND cord AND torsion ) OR TITLE-ABS-KEY ( "Torsion of Testicular cord" ) OR TITLE-ABS-KEY ( torsion AND of AND testicular AND cord ) OR TITLE-ABS-KEY ( "Testicular cord torsion" ) OR TITLE-ABS-KEY ( testicular AND cord AND torsion ) OR TITLE-ABS-KEY ( testicular AND twisting ) OR TITLE-ABS-KEY ( "spermatic cord twisting" ) OR TITLE-ABS-KEY ( test?s AND torsion ) OR TITLE-ABS-KEY ( {testicle torsion} ) OR TITLE-ABS-KEY ( {Testicular infarction} ) OR TITLE-ABS-KEY ( "Spermatic cord ischemia" ) OR TITLE-ABS-KEY ( "Spermatic cord ischaemia" ) OR TITLE-ABS-KEY ( "Testicular cord ischemia" ) OR TITLE-ABS-KEY ( "Testicular cord ischaemia" ) ) ) AND ( ( TITLE-ABS-KEY ( "manual detorsion" ) OR TITLE-ABS-KEY ( {manual detorsion}

) OR TITLE-ABS-KEY ( "manual derotation" ) OR TITLE-ABS-KEY ( {manual derotation} ) OR TITLE-ABS-KEY ( manual AND untwist ) OR TITLE-ABS-KEY ( "manual reduction" ) OR TITLE-ABS-KEY ( {manual reduction} ) OR TITLE-ABS-KEY ( manual AND salvage ) OR TITLE-ABS-KEY ( "manipulative detorsion" ) OR TITLE-ABS-KEY ( {manipulative detorsion} ) OR TITLE-ABS-KEY ( "manual manipulation" ) OR TITLE-ABS-KEY ( {manual manipulation} ) OR TITLE-ABS-KEY ( "Elastic retraction method" ) OR TITLE-ABS-KEY ( {Elastic retraction method} ) OR TITLE-ABS-KEY ( "Push and turn method" ) OR TITLE-ABS-KEY ( {Push and turn method} ) ) )

## CENTRAL – 6 April 2022

The results for the "Problem" search string with trials limit = **19 results**

(mh "Spermatic Cord Torsion") OR "Spermatic Cord Torsions" OR "Spermatic Cord Torsion" OR Spermatic cord torsion OR "Torsion of Testicular Cord" OR Testicular cord torsion OR "Testicular cord torsion" OR "Testicular Torsion" OR "Testicular Torsions" OR Testicular twisting OR "spermatic cord twisting" OR "testis torsion" OR testes torsion OR "testicle torsion" OR "Testicular infarction" OR Spermatic cord ischemia OR Spermatic cord ischaemia OR Testicular cord ischemia OR Testicular cord ischaemia

in Trials

= 19

19 Trials matching "#6 - (mh "Spermatic Cord Torsion") OR "Spermatic Cord Torsions" OR "Spermatic Cord Torsion" OR Spermatic cord torsion OR "Torsion of Testicular Cord" OR Testicular cord torsion OR "Testicular cord torsion" OR "Testicular Torsion" OR "Testicular Torsions" OR Testicular twisting OR "spermatic cord twisting" OR "testis torsion" OR testes torsion OR "testicle torsion" OR "Testicular infarction" OR Spermatic cord ischemia OR Spermatic cord ischaemia OR Testicular cord ischemia OR Testicular cord ischaemia"

*Cochrane* Central Register of Controlled Trials

Issue 3 of 12, March 2022

## AJOL search - 4 April 2022

(spermatic cord torsion OR "spermatic cord torsion") OR (Testicular cord torsion OR "Testicular cord torsion") OR (testes torsion OR testis torsion) = 78 results

Appendix 3: Table of excluded studies

| Study | Study title | Reason for exclusion | Notes |
|---|---|---|---|
| Osifo and Nwajie, 2009 (47) | Acute Inguinoscrotal Lesions in Children-Aetiology, Effects of Delayed Presentation on Management and Outcome in Benin City, Nigeria | No full text available | Abstract only |
| Morel Journel et al., 1998 (48) | Torsion of the spermatic cord and of testicular appendages | No full text available | Abstract only |
| Currie et al., 1989 (49) | Torsion of the testis. | No full text available | Abstract only |
| Chung et al., 2005 (50) | Usefulness of manual reduction in patients with acute scrotum | No full text available | Abstract only |
| Cattolica, 1985 (51) | Preoperative manual detorsion of the torsed spermatic cord | Wrong study design | Case series of 35 / 104 patients who underwent preoperative manual detorsion. No data provided on the outcomes of the immediate surgery group. |
| Li et al., 2020 (17) | The theoretical method and clinical application of testicular torsion. | Wrong study design | Case series of 22/28 patients who underwent preoperative manual detorsion. No data provided on the outcomes of the immediate surgery group. |
| Siu Uribe et al., 2019 (23) | Manual detorsion and elective orchiopexy as an alternative treatment for acute testicular torsion in children. | Wrong study design | Full text translated from Spanish to English.<br>Case series of 16/76 patients who underwent preoperative manual detorsion. No data provided on the outcomes of the immediate surgery group. |

| Study | Study title | Reason for exclusion | Notes |
|---|---|---|---|
| Cattolica et al., 1982 (16) | High testicular salvage rate in torsion of the spermatic cord. | Wrong study design | Study included other causes of testicular pain – Torsed testicular appendage, inflammatory conditions.<br>No clear comparison between MD and immediate surgery |
| Davidson, 1984 (52) | Manual detorsion of testis using xylocaine block. | Wrong study design | Correspondence to the editor in response to case report of testicular torsion in elderly patient. |
| Mugalo, 2016 (28) | Manual Detorsion of Testicular Torsion-A Primary Care Intervention Procedure. Case Reports | Wrong study design | Case series of 3 patients in a low resource setting.<br>No data provided on the outcomes of the immediate surgery group. |
| Hosokawa et al., 2021 (44) | Role of ultrasound in manual detorsion for testicular torsion | Wrong study design | 13 patient case series on patients undergoing manual detorsion investigating end points of detorsion.<br>No comparator group. |
| Cornel and Karthaus, 1999 (53) | Manual derotation of the twisted spermatic cord. | Wrong study design | 17 patient case series demonstrating safety and efficacy pf manual detorsion. |
| Estremadoyro et al., 2017 (54) | Diagnosis and management of testicular torsion in children | Wrong study design | Full text translated from French to English<br>Review paper on diagnostic and management issues in paediatric testicular torsion |
| Townsend et al., 1999 (55) | Colour Doppler evaluation of testicular torsion with subsequent blood flow after immediate manual detorsion | Wrong study design | Single patient case report on 31-year-old male undergoing manual detorsion |

| Study | Study title | Reason for exclusion | Notes |
|---|---|---|---|
| Hosokawa et al., 2022 (45) | Vascular flow to predict testicular compartment syndrome after manual detorsion. | Wrong study design | Case report with 3 patients. No comparator group. |
| Garel et al., 2000 (25) | Preoperative manual detorsion of the spermatic cord with Doppler ultrasound monitoring in patients with intravaginal acute testicular torsion. | Wrong study design | 7 patient case series of patients having manual detorsion under US monitoring.<br>No comparator group. |
| Cannon et al., 1995 (56) | Manual testicular detorsion aided by colour Doppler ultrasonography | Wrong study design | Single patient case report on 15-year-old. |
| Frazier and Bucy, 1975 (57) | Manipulation of torsion of the testicle. | Wrong study design | Four patient case report |
| Dunn, 2008 (58) | Manual detorsion of the testicle. | Wrong study design | Correspondence to the editor in response to case report |
| Haynes and Haynes, 1987 (29) | Manipulative detorsion: beware the twist that does not turn. | Wrong study design | Three patient case report on incomplete detorsion and recurrent detorsion after manual detorsion |
| Kiesling Jr et al., 1984 (21) | Spermatic cord block and manual reduction: primary treatment for spermatic cord torsion. | Wrong study design | 16 patient case series on manual detorsion with pre-procedure spermatic cord block.<br>No comparator group |
| Wang and Scoutt, 2013 (59) | Testicular torsion and manual detorsion. | Wrong study design | Case report |
| Diaz-Ball et al., 1990 (60) | One-dose technetium-99m pertechnetate imaging in acute testicular torsion followed by manual detorsion. | Wrong study design | 4 patient case series of patients having testicular torsion diagnosed by scintigraphy and reperfusion confirmed by scintigraphy. |

| Study | Study title | Reason for exclusion | Notes |
|---|---|---|---|
| Krarup, 1978 (61) | The Testes After Torsion | Wrong comparator | Retrospective cohort study including other causes of scrotal pain |
| Demirbas et al., 2017 (14) | Should manual detorsion be a routine part of treatment in testicular torsion? | Wrong comparator | Retrospective cohort study. Unclear comparator to preoperative manual detorsion |
| Cabral Dias Filho et al., 2022 (41) | Testicular Torsion Patients Should Be Manually Detorsed at Diagnosis: A Propensity Score Matched Analysis of the Influence of Interhospital Transfer and Surgical Wait Times on Surgical Organ Salvage | Wrong comparator | Retrospective cohort study comparing immediate preoperative manual detorsion to hospital transfer and manual detorsion. |
| Murithi et al., 2017 (62) | Management and Outcome of Testicular Torsion | Wrong intervention | Audit of testicular torsion outcomes at 2 referral facilities.<br>Manual detorsion was not used in any of the patients |
| Maranya et al., 2011 (63) | Dismal salvage of testicular torsion: A call to action! | Wrong intervention | Audit of testicular torsion outcomes at 2 referral facilities.<br>Manual detorsion was not used in any of the patients |
| Ibingira, 2001 (64) | Management of Testicular torsion in Mulago Hospital over a 5-year period | Wrong intervention | 5-year review of patients presenting with testicular torsion. Manual detorsion not performed. |
| Mukendi et al., 2020 (65) | Characteristics and management of testicular torsion in patients admitted to the Urology Department at Chris Hani Baragwanath Academic Hospital | Wrong patient population | Retrospective review of 308 patients presenting with testicular torsion over an 8-year period. 32/308 had manual detorsion however done up to 48 hours after symptom onset |