Definition

- Full or partial erection that continues >4 hours
  - beyond sexual stimulation and orgasm, or
  - unrelated to sexual stimulation
Ischaemic (veno-occlusive / low flow)

Priapism

- Persistent rigidity of corpora cavernous with little or no cavernous arterial inflow.
- Time-dependent changes in the corporal metabolic environment with progressive hypoxia, hypercarbia and acidosis.
- Pain after 6 to 8 hours
- Initial occlusion of venous outflow and subsequent cessation of arterial inflow.
- Intervention beyond 48 to 72 hours can relieve pain but no benefit in preserving potency.
- Initial interstitial edema, then destruction of sinusoidal endothelium, exposure of basement membrane, thrombocyte adherence, leading to smooth muscle necrosis.
- Urological emergency. If untreated, may take days to resolve and invariably results in ED.
Stuttering Priapism (intermittent)

- pattern of recurrence
- historically describes recurrent unwanted and painful erections in men with sickle cell disease
- recurrent episodes may lead to ischaemic priapism,
Non-ischaemic priapism (arterial, high-flow)

- unregulated cavernous arterial inflow.
- typically, corpora tumescent but not rigid.
- Penis not painful
- History of blunt trauma or iatrogenic needle injury common.
- injury results in disruption of cavernous arterial anatomy creating arteriolar-sinusoidal fistula
- *no hypoxia, hypercarbia or acidosis* in cavernous blood gas.
- Does not require emergent management
- no pain beyond acute trauma.
- Associated with normal erectile function
Aetiology of Ischemic Priapism (Veno-occlusive, low flow)

- accounts for majority of reported cases
- may begin with sexual stimulation or administration of pharmacologic agents
- but persists beyond 4 hours
- includes hematologic dycrasias and iatrogenic causes
Hematologic dyshrases

- SCD, thalassemia, thrombophilia
- Thrombotic disease states - asplenism, erythropoietin use, hemodialysis with heparin use, cessation of coumadin therapy
- Excessive white cell counts i.e. leukaemia (up to 5%)
- May be from secondary metastatic infiltration of solid lesions, i.e. bladder and prostate Ca, though very rare.
- Iatrogenic medications
  - intracavernosal injection
    - alprostatil - up to 5% have priapism.
    - Papvarine/phentolamine/alprostatil - prolonged erection in 5-35%
  - PDE5 inhibitor
    - rare reports of priapism
    - higher risk if co-existing SCD, spinal cord injury, history of penile trauma, concurrent use with psychotropic medications and narcotics.
<table>
<thead>
<tr>
<th><strong>TABLE 25-1 Etiologies of Priapism</strong></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>α-Adrenergic Receptor Antagonists</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Prazosin, terazosin, doxazosin, tamsulosin</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Antianxiety Agents</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydroxyzine</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Anticoagulants</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Heparin, warfarin</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Antidepressants and Antipsychotics</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Trazodone, bupropion, fluoxetine, sertraline, lithium, clozapine, resperidone, olazapine, chlorpromazine, thioridazine, phenothaizines</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Antihypertensives</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydralazine, guanethidine, propanolol</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Drugs (Recreational)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol, cocaine (intranasal and topical), crack cocaine, marijuana</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Genitourinary</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Straddle injury, coital injury, pelvic trauma, kick to penis/perineum, arteriovenous or arteriocavernous bypass surgery, urinary retention</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Hematologic Dyscrasias</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sickle cell disease, thalassemia, granulocytic leukemia, myeloid leukemia, lymphocytic leukemia, multiple myeloma, haemoglobin Olmsted variant, fat emboli associated with hyperalimentation, hemodialysis, glucose 6-phosphate dehydrogenase deficiency</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Hormones</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gonadotropin-releasing hormone, testosterone</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Infectious (Toxin Mediated)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Scorpion sting, spider bite, rabies, malaria</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Metabolic</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Amyloidosis, Fabry disease, gout</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Neoplastic (Metastatic or Regional Infiltration)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Prostate, urethra, testis, bladder, rectal, lung, kidney</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Neurogenic</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Syphilis, spinal cord injury, cauda equina compression, autonomic neuropathy, lumbar disk herniation, spinal stenosis, cerebral vascular accident, brain tumor, spinal anesthesia, cauda equina syndrome</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Vasoactive Erectile Agents</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Papaverine, phentolamine, prostaglandin E₁, oral phosphodiesterase type 5 inhibitors, combination intracavernous therapy</td>
</tr>
</tbody>
</table>
Aetiology of Stuttering (intermittent Priapism)

- typically, patients awaken with erection that persist up to 4 hours and becomes progressively painful secondary to ischaemia.

- SCD (up to 35%)
Aetiology of Nonischaemic Priapism (Arterial, High-flow)

- caused by unregulated cavernous arterial inflow.
- much rarer than ischemic priapism
- Caused largely by trauma (blunt or penetrating)
  - laceration of cavernous artery or branches
  - usually reported as straddle injury to the crura
  - coital trauma kicks to penis or perineum, pelvic fracture, birth canal trauma to newborn male, needle lacerations,
  - vascular erosions from metastatic infiltration of the corpora
  - complications of penile diagnostics
- iatrogenic
  - post cold-knife urethrotomy
  - Nesbitt corporoplasty
  - Deep dorsal vein arterialisation
- Following aggressive management of ischaemic priapism or surgical shunting (convert from ischaemic to high-flow, formation of arteriolar - sinusoidal fistula at intervention site
Evaluation

- Aim is to distinguish underlying priapism hemodynamics as ischemic (emergent management) or nonischemic.

- History
  - pain
  - duration
  - previous episodes and method of treatment, baseline erectile function
  - use known drug associated with priapism
  - associated SCD or other blood dyscrasia
  - known neurologic condition, i.e. spinal cord
  - recreational drug use,
  - Trauma to pelvis, perineum, penis
Physical examination

- inspection and palpation to determine extent and degree of tumescence and rigidity

- involvement cavernous bodies, presence of pain, evidence of trauma.

- corporal bodies completely rigid, glans and corpus spongiosum not rigid in ischaemic priapism

- Malignant infiltration (examine abdomen, testicles, perineum, rectum and prostate)
TABLE 25–3  Key Findings in Priapism

<table>
<thead>
<tr>
<th>FINDINGS</th>
<th>ISCHEMIC PRIAPISM</th>
<th>NONISCHEMIC PRIAPISM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perineal trauma</td>
<td>Seldom</td>
<td>Usually</td>
</tr>
<tr>
<td>Hematologic abnormalities</td>
<td>Usually</td>
<td>Seldom</td>
</tr>
<tr>
<td>Recent intracorporal injection</td>
<td>Sometimes</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Corpora cavernosa fully rigid</td>
<td>Usually</td>
<td>Seldom</td>
</tr>
<tr>
<td>Penile pain</td>
<td>Usually</td>
<td>Seldom</td>
</tr>
<tr>
<td>Abnormal penile blood gas</td>
<td>Usually</td>
<td>Seldom</td>
</tr>
<tr>
<td>Cavernous inflow (by Doppler)</td>
<td>Seldom</td>
<td>Usually</td>
</tr>
</tbody>
</table>
* Labs

* FBC - WBC with blood cell differential, platelet count

* Coagulation profile

* Sickle cell prep and Hb Electrophoresis if suspecting SCD

* Urine and serum toxicology - if suspect recreational narcotic abuse

* Corporal blood gas by aspiration - differentiates ischemic from non ischemic priapism.

* diagnostic and therapeutic

* Color duplex doppler Ultrasound (if suspected high flow or ABG shows well oxygenated blood
<table>
<thead>
<tr>
<th>SOURCE</th>
<th>$\text{Po}_2$ (mm Hg)</th>
<th>$\text{Pco}_2$ (mm Hg)</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal arterial blood (room air)</td>
<td>$&gt;90$</td>
<td>$&lt;40$</td>
<td>7.40</td>
</tr>
<tr>
<td>Normal mixed venous blood (room air)</td>
<td>40</td>
<td>50</td>
<td>7.35</td>
</tr>
<tr>
<td>Ischemic priapism (first corporal aspirate)</td>
<td>$&lt;30$</td>
<td>$&gt;60$</td>
<td>$&lt;7.25$</td>
</tr>
</tbody>
</table>
Color Duplex Doppler Ultrasound (CDU)

- recommended as adjunct to corporal aspirate in differentiating ischemic and non-ischemic.
- localize characteristic blush from disrupted cavernous artery / arteriole (in high flow)
- Done in conjunction with clinical assessment and blood gases

Penile arteriography - reserved for high flow priapism, when embolisation is planned. Otherwise too invasive.

MRI

- imaging of well-established arteriolar - sinusoidal fistula
- demonstrate presence and extent of tissue thrombus and corporal smooth muscle infarction in ischemic priapism
- Imaging or corporal metastasis mimicking priapism.
A, Examination of the crural bodies is required when searching for arterial sinusoidal fistula following straddle injury.
B, Color Doppler image of arterial sinusoidal fistula of left cavernous artery.
Management

- Oral agents, i.e. terbutaline is not recommended
- Initial treatment of ischemic priapism is decompression via aspiration.
  - Soften erection and relieve pain
  - May relieve priapism 36% of the time
  - May consider cold saline irrigation (up to 66% success)
  - Aspiration repeated until no more dark blood coming from corpora and fresh bright red blood obtained.
Aspiration

- single, large-bore 19 gauge needle inserted at peno-scrotal junction at 3 or 9 o clock (avoids piercing dorsal neuromuscular bundle)
- compress penile shaft between thumb and first digit just below 19 gauge needle
- aspirate shaft till soft.
- leave needle in place and allow shaft to refill
- reapply compression and repeat aspiration
- Repeat till oxygenated blood seen
If fail, follow by alpha adrenergic injection or irrigation

- causes cavernous smooth muscle contraction

- phenylephrine is agent of choice (selective alpha 1 adrenergic receptor agonist without beta mediated inotropic and chronotropic cardiac effects)

- phenylephrine concentrated to 200mcg/ml in saline

- administered intermittently as 0.5ml to 1.0ml, every 5 to 10 minutes

- maximum dose of 1mg

- Aspirate penis between successive injections by tightly pinching shaft at peno-scrotal junction, aspirate till distal shaft is empty.

- inject and release compression to allow shaft to refill with fresh blood

- Monitor BP and Pulse during and after

- potential side effects include headache, dizziness, hypertension, reflex bradycardia, tachycardia and irregular cardiac rhythms.

- No maximum safe dosing but hypertensive stroke has been reported at 2mg
Surgical management
Ischemic priapism

- indication
  - failed repeated penile aspirations
  - failed injection of sympathomimetics
  - significant cardiac side effects from medical management

- Timing
  - early intervention for malignant or poorly controlled hypertension
  - men using MAOI, which is contraindicated for alpha agonist use
  - 2004 international Consultation on sexuel medicine, Paris
  - corporal aspiration and alpha agonist injection for at least 1 hour before surgery

- Need to discuss and document baseline erectile function, duration priapism, risks and benefits of surgery and ED.
* Pryor, 1982 - priapism more than 24 hours - 90% ED

* Kulmala et al, 1995 - preservation of 92% erectile function if reversed <24 hours

* Bennett and Mulhall, 2008
  * reverse <12 hrs - 100% spontaneous erection
  * reverse 12 - 24 hrs - 78% spontaneous erection
  * reverse 24-36 hrs - 44% spontaneous erection
  * reverse longer than 36 hrs - 0% spontaneous erection
International Society of Sexual medicine standards committee (expert opinion)

- only consider shunting if <72 hours
- forego shunting if
  - evidence of cavernous thrombosis is evident
  - no blood can be aspirated from corpora.
Shunts

* objective is **reoxygenation** of cavernous smooth muscle

* re-establish corporal inflow by relieving venous outflow obstruction, i.e. creating a fistula between

  * corpora cavernosa (CC) and glans penis,
  * CC and Corpus spongiosum, or
  * CC and dorsal / saphenous veins

* divided on basis of anatomic location on the penis.
Types of Shunts

- Percutaneous distal shunts - Ebbehoj (1974), Winter (1976) or T-shunt (Brant, 2009)
  - usually first choice
- Open Distal shunt - Al-Ghorab (Hanafy, 1976, Borrelli, 1983) or Corporal Snake (Burnett, 2009)
  - If failed percutaneous approach
- Open Proximal Shunt - Quackles (1964) or Sacher (1972)
  - If failed distal shunt
- Saphenous vein - Grayhack (1964)
  - increased risk of thromboembolism
- Deep Dorsal vein shunt - Barry (1976)
Winter shunt. A distal cavernoglanular shunt procedure is depicted by the transglanular placement of a large-bore needle or angiocatheter in the distal glans and corpus cavernosum.
A, A No. 11 blade is used for an Ebbehøj percutaneous cavernoglanular shunt, and a No. 10 blade is used for a T shunt.

B and C, Note the differences between the Ebbehøj and T shunts. In the Ebbehøj technique the No. 11 blade leaves a straight incision into the glans and corpus cavernosum. In the creation of a T shunt the No. 10 blade is rotated 90 degrees after insertion and withdrawn. In both the percutaneous techniques deoxygenated blood is milked out of the open wounds; once bright red blood is seen, the skin is closed, leaving the deeper incision as the open fistula. In either procedure the maneuver may be repeated on the opposite corpora.
A-C, An open corporoglanular shunt is indicated if percutaneous shunting fails to reestablish cavernous blood inflow. The Al-Ghorab shunt requires the excision of circular cone segments of the distal tunica albuginea (5 × 5 mm).

- **Under GA**
- **2-cm transverse incision on the glans**
- **distal tips of rigid corpora cavernous incised and grasped with 2-0 stay sutures / Kocher clamps**
- **Deoxygenated blood milked out**
- **repeat and close glans with chromic suture**
The proximal open shunt technique to establish communication between the corpus spongiosum and corpus cavernosum was first described by Quackles in 1964.

Bilateral shunts are staggered. The right and left sides are separated by a distance of at least 1 cm in an effort to minimize the risk of urethral stricture at the point of corpus cavernosum to spongiosum communication (Sacher, 1972).
A. Venous bypass to control ischemic priapism was first described by Grayhack in 1964. The Grayhack shunt mobilizes the saphenous vein below the junction of the femoral vein and anastamoses the vein end to side into the corpus cavernosum.

B. Deep dorsal vein (DDV) shunt with distal ligation of DDV and anastamosis of proximal DDV to corpus cavernosum. A wedge of tunica albuginea is removed.
Key factors for successful shunting

- evacuation of thrombus
- re-establishment of cavernous inflow
- patency of shunt

Patency confirmed by

- bright red blood from corporal bodies
- falling intracavernous pressure
- penis detumesce and refill with sequential compression and release
- color doppler ultrasound showing cavernous artery inflow

Possible complications

- penile oedema, hematoma, infection, urethral fistula, penile necrosis, venous thromboembolism leading to pulmonary embolism

Followup

- Follow up on erectile function and treat if ED
Penile prosthesis

- untreated ischemic priapism / priapism refractory to intervention will have severe fibrosis, penile length loss and complete ED
- immediate implantation after failed sympathomimetic intracavernous therapies and shunting proposed
  - corporal fibrosis not yet established, easier insertion
  - preserve penile length
  - timing still unclear.
  
- document baseline erectile function, duration of priapism, history of stuttering, prior interventions
- Consider if
  - failed aspiration and intracavernous injection
  - failed distal and proximal shunting
  - ischemia present >36 hrs
- MRI before surgery or corporal biopsy to document corporal smooth muscle necrosis
- higher rates of complications
  - infection, urethral injury, device migration, device erosions, revision surgeries
Interventional angiography in High-Flow Priapism

- not an emergency
- spontaneous resolution in up to 62% of cases (Montague et al, 2003, Pryor 2004)
- watchful waiting initially
- embolisation (in patients demanding immediate relief)
- selective internal pudendal artery catheterisation
- pathognomonic finding - arterial-lacunar fistula
- use of autologous blood clots and absorbable gas
- Risk of ED if use permanent agent (microcoil, gelfoam)
- Success rate between 89 - 100%
- Recurrence rate 30 - 40%
- Risk
  - ED (up to 20%) penile gangrnee, gluteal ischaemia, purulent cavernositis, perineal abscess.
Color Doppler ultrasonography of the penis and perineum is recommended in the evaluation of priapism, when the history or examination suggests penile trauma (A). Doppler sonography for localization of a fistula correlates well with selective pudendal angiography (B, C, D, E); a characteristic fistula blush is shown (B, D), along with normal arteriograms (C, E).
Surgical treatment of High Flow Priapism

- Not an emergency, managed expectantly
- Diagnosed on penile/perineal colour doppler ultrasound
- Surgical ligation indicated if angio-embolisation failed or contraindicated
- Formation of pseudo capsule at site of sinusoidal fistula may take weeks to months following trauma
- CDU used during transcorporal exploration to locate fistula for ligation.
- Risk - corporal exploration before formation of pseudo capsule may result in ligation of cavernous artery rather than fistula
Conclusion

- Prompt diagnosis and appropriate management to preserve erectile function
- Differentiate ischemic from non-ischemic
“Thank you for your kind attention”