Principles of Limb Sparing and complications

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Overview

- Historical review
- Locations
- Techniques
- Complications
Introduction - History

- Appendicular Osteosarcoma
- Amputation
- Limb spare
  - Survival rates
  - Good function reported
    (69-80%)
History

- 1977 : Theilen et al
- 1987 : Vasseur
- 1989 : LaRue et al
  - First study with proper follow-up
  - Downstaging involved → cisplatin & radiation
  - Allograft
History

- Development of endoprosthesis
- Liptak et al 2006
  - Similar failure rates
  - Biomechanical performance
  - Resistance to implant failure in axial compression
  - Availability

(Liptak et al 2006)
Case Selection

- Location
- Margins
  - Bone (<50%)
  - Soft tissue
- Concurrent orthopaedic/neurological problems
- Client
- Pathological fracture
Oncologic Principles

- Diagnosis & staging
- Local staging & surgical planning
- Adjuvant therapy

(Tobias & Johnston 2012)
Locations

- Success mainly related to arthrodesis (Resection)
- Distal radius
- Proximal humerus
- Distal tibia
- Proximal femur

(Liptak et al 2005)
Proximal Humerus

- Kuntz et al 1998
  - Retrospective study, n:17
  - Scapulohumeral arthrodesis
    + frozen allograft
  - 12% functional outcome
  - High complication rate
- Liptak et al 2004 - IORT
Distal Tibia

- LaRue et al 1989
  - 2 cases

- Rovesti et al 2002: Double bone transport osteogenesis

- IORT
  - Poor outcomes
Proximal Femur

- Humans
- Vasseur 1987
- Liptak et al 2005
  - Single case report
  - Femoral composite graft and allograft
  - Custom femoral stem
  - Excellent – good function
- IORT – Liptak 2004

(Liptak et al 2005)
Limb Sparing Techniques - Dog

- Cortical Allograft
  - Longest standing technique

- Endoprosthesis
  - Locking screws
  - Most commonly used
Techniques

- Autografts
  - Pasteurised autograft
    - Morello et al 2003
  - Intraoperative radiation
  - Vascularised ulnar transposition
    - Sequin et al 2003

(Seguin et al 2003)
Techniques

- Stereotactic radiosurgery
  - Not widely available

- Bone transport osteogenesis
  - Double bone, Transverse

- Partial amputation + endoprostheses
  - Intraosseous transcutaneous amputation prosthesis (ITAP)
Techniques

- Intercalary
  - Liptak et al 2004
  - Complications 31.3%
  - Implant failure 25%

- Ulnectomy
  - Lateral collateral ligament
Complications

- Infection
- Local recurrence
- Implant failure
- Technique specific
Complications - Infection

- Reports range from 40% - 75%

- Reasons
  - Extensive surgical time and exposure
  - Vascular and lymphatic interruption
  - Lack of remaining soft tissue
  - Large implant/graft
  - Adjunctive therapy

- Treatment / Management
Complications – Infection

- Every cloud has a silver lining
- Lascelles et al 2005
  - 32/47 dogs (68%) developed infection
  - MST dogs with infection: 480 days vs 228 days for non-infection
- Liptak et al 2006
  - Prospective study endoprosthesis vs allograft
  - MST dogs with infection: 685 days vs 289 days for non-infection
Complications - Infection

- **Humans**: Reported in postoperative infection after resection of bronchogenic and laryngeal carcinomas

- **Mechanism – unknown**
  - Proposed theory: Upregulation of cell-mediated or humoral antitumor immunity
    - Macrophages / cytotoxic cells that cause production of antiangiogenic factors
    - Cytokine cascade to overcome chemoresistant clones
Complications – Local recurrence

- 11-28%
- Risks
  - Disruption of tumour pseudo capsule
- En bloc resection of ulna
  - Biomechanical aspects & no association with implant failure (Liptak et al 2006b, Kirpensteijn et al 1998)
- Recurrence does not affect survival
- Management
Complications – Local recurrence

- Withrow et al 2004
  - Intracavitary cisplatin
  - Open cell polylactic acid with 8% cisplatin (OPLA-Pt)
  - Rate of local recurrence reduced
  - Increased time to local recurrence
  - Rate of local recurrence not statistically significant
  - 2 times less likely to develop local recurrence
  - Low systemic toxicity - not statistically significant
Complications – Implant failure

- Liptak et al 2006 study:
  - 40% implant failure rate
  - Allograft failure distally, endoprosthesis proximally
Complications – Implant failure

- Silver lining
- MST 685 days for dogs with construct failure vs 322 days without construct failure.
- Independent of infection
- Mechanism unknown – constant screw motion → inflammatory and subsequent immunologic reaction?
Complications – Technique Specific

- **Irradiated bone autografts**
  - Pathological fracture
    - Common complication in humans
    - Liptak et al 2004 : 54%
    - No reduction with use of intramedullary PMMA

- **Prevention : Combination of 2 implants (DCP,ILN) recommended.**
Conclusion

- Amputation
- Treatment goals
  - Function
  - Survival time
- High complication rate
- Ongoing studies

Farese et al 2004
Questions

Who?

Where?

What?

When?