Secondary intramedullary nailing for treatment of complications after bone lengthening

30 patients followed for 2-12 years

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Distraction osteogenesis

progressive distraction → biological reaction

- increase of leg vascularization
- 'growth plate' phenomenon
- development of membranous ossification
Problems and Complications

- pain
- neurologic – vascular injury
- premature consolidation
- joint subluxation or dislocation
- axial deviation
- pin-tract problems
- joint stiffness
- delayed callus consolidation
Distraction osteogenesis

Bone transport - docking site

- poor vascularization
- soft tissue interfering
- not good bone contact

delayed consolidation - nonunion

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Distraction osteogenesis

PROLONGED USE OF THE EXTERNAL FIXATOR
Distraction osteogenesis

The prolonged use of the external fixator is the most difficult aspect of lengthening for the patient to tolerate

PREMATURE REMOVAL

fracture (9.4% Simpson and Kenwright, JBJS 2000)

deformity

shortening

non-union (Paley et al, JBJS, 1997)
Secondary intramedullary nailing after callus distraction

intramedullary nail application during the **consolidation phase** after bone lengthening or bone transport for further **stabilization** of the lengthened callus, and **enhancement** of callus maturation and docking site union.
BONE LENGTHENING OR BONE TRANSPORT WITH EXTERNAL SYSTEM

- intolerance of the external device
- angular deformity or fracture
- docking site nonunion
- delayed callus maturation

INTRAMEDULLARY NAILING

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Secondary intramedullary nailing

essential conditions

- completion of bone lengthening
- reestablishment of soft tissues
- absence of clinical and laboratorial signs of infection

normal WBC and ESR
free of clinical signs of infection (even pin track infections)
Secondary intramedullary nailing

**Material-methods**

1991 – 2001: 30p (14.29%)
M/F : 27/3
Age: 10-68 (30.4)
Femur 13, Tibia 20

- Post-traumatic bone defect (PBD)
- Septic nonunion (SN)
- Aseptic nonunion (AN)
- Chronic osteomyelitis (CO)
- Anisoscelia (A)
- Peronial hemimelia (PH)

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Secondary intramedullary nailing

- In 25 cases, the nail insertion was performed immediately after the Ilizarov frame removal.

- In 5 cases with unilateral lengthening system the nailing was delayed for approximately 2 weeks after the external device removal.

- In 3 patients nailing was performed because of fracture at the callus area some days or weeks after the removal of the external device.

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Secondary intramedullary nailing

One stage conversion

- Traction table
- Frame and pins removal – antiseptic infusion
- Opening of the canal with a long awl
- Reaming at the docking site
- Static nailing
Secondary intramedullary nailing

Results (follow up 2-12 years)

- Docking site healing (average 5.9 months)

  - Obvious radiologic healing within six months in 10 cases (58.8%).
  - Delayed radiologic ossification in 6 cases (35.3%).
  - Non healing in 1 case (5.8%).

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Secondary intramedullary nailing

Results (follow up 2-12 years)

- Callus length

Length retained in 27 cases

1-2 cm shortening of the callus in 5 cases (two stages conversion)
Secondary intramedullary nailing

Results (follow up 2-12 years)

- Infection
  - Intramedullary infection
  - Superficial infection

- Intramedullary infection: 30 (91%)
- Superficial infection: 2 (6%) and 1 (3%)

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Case 1: male 29y

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Case 2: male 44y
Case 3:

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Case 4

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Case 6
Intramedullary nailing

- Approach far from neo-osteogenesis area
- Non-rigid fixation on the new bone site
- Preservation of periosteal vascularization
The extensive proliferation of periosteal vessels after a reamed intramedullary nailing in combination with the products of the reaming that acting as bone-inductive agents for bone growth, have been shown to improve the growth of subperiosteal callus via the process of membranous ossification.
Conclusions

Secondary intramedullary nailing...

...releases the patient earlier from the bulky system of external osteosynthesis

...protects the immature lengthened callus from deformities

...promotes the process of ossification at the callus area and/or the docking site
Conclusions

in these specific cases intramedullary nailing **completes** the treatment by stimulating the biology basis of distraction osteogenesis
ΕΥΧΑΡΙΣΤΩ