Management of Diaphyseal fracture non-union and delayed-union (Femur and Tibia) By SIGN Nail

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Approximately 5% of all long bone fractures will result in non-union and even more in delayed-union.
Introduction

- Fracture non-union and delayed-union may represent a small percentage of traumatologist’s case load but they can account for high percentage of surgeons, stress, anxiety, and frustration.
Introduction Contd...

• Fracture non-union and delayed-union is a chronic medical condition associated with pain, functional and psychological disability.

• Due to wide variation in patients response to various stress with the impact that may have on the family (relationship, income etc) these cases are often difficult to manage.
Some 90 to 95% of all fractures heal without problem.

Non-union and delayed-union are that small percentage of cases in which the biological process of fracture repair cannot overcome the bone biology and mechanics of the bony injury.
Definition

- Non-union (some what arbitrary)
  - A fracture that has not going to heal.
- Delayed Union
  - A fracture that requires more time than usual to heal.
  - shows progression over time.
Definition Contd......

- Non-union – A fracture that is a minimum of 9 months post occurrence and is not healed and has not shown radiographic progression for 3 month.

(FDA-1986)
Definition Contd......

• Not pragmatic
  - prolonged morbidity
  – Narcotic abuse
  – work related or emotional impairment.
Definition Contd......

• Pragmatic –
  Non-union : A fracture that has no potential to heal without further intervention.
Definition Contd......

• “The designation of a delayed-union or non-union is currently made when the surgeon believes the fracture has little or no potential to heal ”

Donald Wiss MD and William Stetson MD
Operative treatment for Delayed or Nonunion

- Debridement and Hardware removal
- Plate osteosynthesis
- Intramedullary Nailing
- External fixation

**Combined with**

- Autogenous Bone graft
  - Bone marrow Aspirate
- Allograft bone
  - Demineralized Bone matrix
- BMPs
- platelet concentrate

Reamed bone
Iliac crest chips
Advantages of Intramedullary Nailing with SIGN nail

• Mechanically stabilizes long bone non-union and delayed-union as a load sharing implant.
• Allow early weight bearing.
• Allow early active mobilization of adjacent joints.
• Manage malalignment – starting and ending point entrance and exit angle of each fragment.
Advantages of Intramedullary Nailing with SIGN nail contd.....

- Initially destroys endosteal blood supply (will recover) but increase periosteal Blood supply.
- Can be performed without direct exposure or dissection of the fracture soft tissue envelope.
- Can be performed in conjugation with an open exposure of the nonunion site and Reamed bone grafting.
Methods

• Place of study – Comilla medical college and Hospital, Bangladesh.
• Type of study – Prospective
• Study period: Jan 2008 – Feb 2015
• Number of cases - 130
Comilla Medical College & Hospital.
Dept of Orthopedic surgery
Comilla Medical College & Hospital.
Patient selection criteria

• All the adult patients with radiological non-union and delayed-union were selected randomly from OPD irrespective of sex, pattern of fracture, nature of trauma and initial treatment.
Patient Evaluation

- History of injury and treatment
- Medical history and co morbidity
- Physical exam- including deformity
- Imaging
- Patient needs, Goals, expectation.
History of injury

- Date and nature of original injury
- Open or closed injury
- Prior surgical procedure
- H/O drainage or wound healing Difficulties
- Prior infection
- Current symptoms – Pain, deformity, motion problems, chronic drainage
- Ability to work and perform ADLS.
Medical history

• Diabetes
• Physiological age related co-morbidity (heart disease, Kidney / liver disease, COPD.)
• Nutritional status
• Smoking
• Medications
• Mal treatment & patients non compliance
• Ambulatory/functional status now and prior to original injury.
Physical examination

• Appearance of limb- color, skin quality, prior incisions, skin graft, Erythema or drainage.
• Range of motion of adjacent joint.
• Pain- location and contributing factor.
• Strength, ability to bear weight.
• Vascular and neurological status.
• Deformity – length alignment and rotation.
Imaging

• Serial plain radiograph from injury to present (frequently not possible )
• Most current imaging – plain digital radiograph.
Goal and expectations

- What are the patients goal and need.
- Household ambulation VS community ambulation.
- Pain relief expectation.
- Range of motion expectations – long standing non-union may have stiff adjacent joints.
- Sound healing expectation.
- Equal limb length expectation.
- Risk to neurovascular structure.
Observations

- Average morbidity period was 09 month

110 (84.61%) – Male
20  (15.38%)  – Female
80  (61.51%)  -- Right side
50  (38.46%)  – Left side
119 (91.53%)  – Open fracture
11  (8.46%)   -- Closed fracture
Sex distribution

- Male
- Female
Side distribution

![Bar chart showing side distribution with two categories: Right and Left. The Right category has a higher value.]
Nature of fracture

- Open
- Closed
Method of reduction and fixation

- 115(88.46%) – ORIF with SIGN Nail and reamed bone graft.
- 15(11.53%) -- CRIF with SIGN nail.
Follow up
At monthly interval both clinically and radiographically

- Total patient – 130
  - Available complete Follow up
    - 55 (42.3%)
  - Dropped and non responding
    - 75 (57.7%)
Result (55 patient)

- United and full range of movement -53 (96.36%)
- Un-united -2 (3.63%)
- Infection – none
- Nail Breakage or failure-- none
CLINICAL CASES
FEMUR
Mr. Abdur Rashid

Follow-up X-ray

X ray on final Follow-up
Mr. Bayezid

Preoperative X ray

Postoperative X ray
Mr. Bayezid

Follow-up X-ray

X-ray on final Follow-up
Mr. Mannan

X ray on final Follow-up
Mr. Mustafa

X-ray on final follow-up
Mr. Rajjab Ali

Preoperative X ray

Postoperative X ray
Mr. Rajjab Ali

Follow-up X-ray

X-ray on final Follow-up
Mr. Rajjab ali

Removal of implant after solid union
Mr. Seraj Miah

Preoperative X ray

Postoperative X ray
TIBIA
Mr. A Rahim

Preoperative X ray

Postoperative X ray
Mr. A Rahim

Follow-up X-ray

X ray on final Follow-up
Mr. Abul Basher

Preoperative X ray

Postoperative X ray
Mr. Abul Basher

X ray on final Follow-up
Mr. Ashraf

Preoperative X ray

Postoperative X ray
Mr. Ashraf

X ray on final Follow-up
Mr. Masud Rana

Follow-up X-ray I

Follow-up X-ray II
Mr. Masud Rana

X ray on final Follow-up
Mrs. Panna Begum

X ray on final Follow-up
Mr. Samsul Huq

Preoperative X ray

Postoperative X ray
Mr. Shamsul Haque

Follow-up X-ray I

Follow-up X-ray II
Mr. Shamsul Haque

X ray on final Follow-up
Mr. Shahin

Preoperative X ray

Postoperative X ray
Mr. Shahin

Follow-up X-ray I

Follow-up X-ray II
Discussion

• Surgical management requires sound understanding of the principle and biomechanics of internal fixation.
• Biology of fracture union.
• Individualized treatment plan and specific goals.
• Limits of the specific implants employed.
Discussion contd....

- Following fixation with **SIGN nail** solid union achieved both in delayed and non-union cases.
- Early and active mobilization of adjacent joints was satisfactory.
- Due to solid nail construct early weight bearing was possible without breakage or failure of implant.
- Patients satisfaction was optimum in all cases.
Conclusions

• Observation and results from this series on the management of non-union and delayed-union of diaphyseal fracture of long bone (femur and tibia) by SIGN nail stands to be gold standard.
THANKS