

学术探讨

框式梯形加压钢板的研究与临床应用

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摘要: 双臂式的框式梯形加压钢板根据生物力学原理, 从加强内固定的稳定性出发设计而成。经 37 例临床使用疗效满意。在钢板摘除中未发现 1 例有断钉, 拔钉现象, 亦无断端重新骨折现象。

关键词: 骨折固定术 框式梯形加压钢板

我们根据生物力学原理, 从加强内固定的稳定性出发, 合理的选用惯性矩, 设计了双臂式的框式梯形加压钢板, 经过 37 例临床应用, 取得了较满意效果。

材料与方 法

1. 材料: 选用 316 不锈钢 (或 1Cr18Ni9Ti) 强性模量 $E = 2 \times 10^6 \text{ N/cm}^2$, 抗拉强度 58 KN/cm^2 , 延伸率: $\delta = 38\%$, 断面收缩率: $\psi = 28\%$ 。

2. 结构: 该钢板由长臂, 短臂和横梁构成, 在长臂短臂与横梁的交叉处各设一个加压螺钉孔, 整个结构形成一个框式梯形。该钢板根据骨折断端的位置分成不同臂长和不同横梁的四种型号, 使用时按骨折部位弯成相应的弧形钢板 (如图 1)。

惯性矩是普通钢板的 5 倍, 说明框式梯形加压钢板接近普通钢板抗弯能力的 5 倍。

2. 抗扭强度: 如图 (2) 所示, 从图中可以看出, 抗扭的能力基本一致, 说明横向扭转的能力近似。

$M_n(\text{N} \cdot \text{m})$

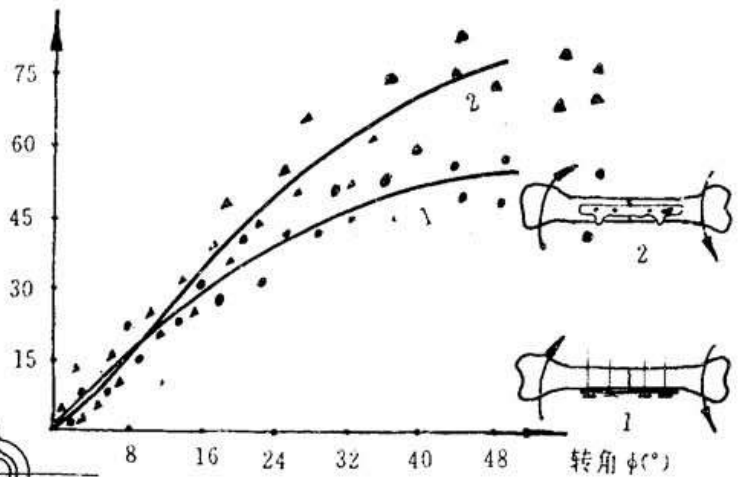


图 2 转角与扭矩图

3. 螺钉的受力状态: 框式梯形加压钢板多为两排, 分别固定于股骨的外侧和前内侧, 交角约为 30° , 在受弯扭组合应力作用下, 所有螺钉主要受剪应力作用, 普通钢板或改型直钢板由于单排螺钉固定, 主要受弯曲作用, 这种弯曲所产生的拉应力是引起拔钉、断钉的根本原因。而该钢板的双排螺钉, 主要受剪应力作用, 所以, 不会产生拔钉和断钉现象。

临床资料

1. 一般资料: 利用该钢板治疗股骨骨折 37 例, 男性 31 例, 女性 6 例, 年龄 20~72 岁, 平均年龄 34.1 岁, 其中股骨干中上段 15 例, 股骨干中下段 14 例, 其它 9

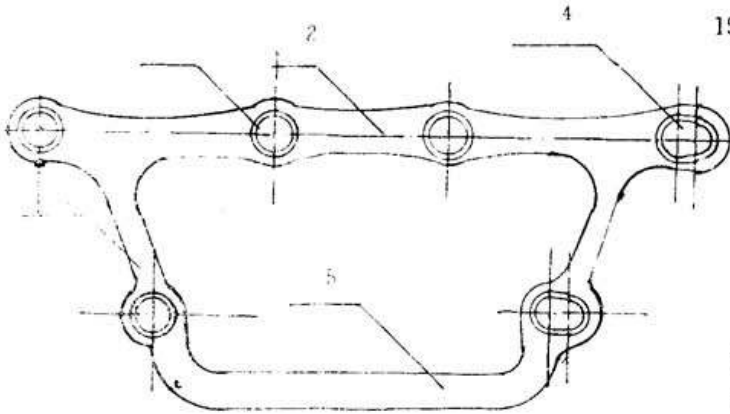


图 1 框式梯形加压钢板结构

1. 横梁 2. 长臂 3. 普通螺钉孔 4. 加压螺钉孔 5. 短臂

简单的力学分析与计算

1. 在股骨、胫骨骨折的钢板内固定中, 钢板受弯、扭、压的组合应变力, 以弯矩为主, 扭矩次之, 拉压应力仅是弯曲应力的 $1/8 \sim 1/12$, 可以忽略不计。根据材料力学的理论, 在受外力的作用下, 同样面积的材料, 抗弯模量 (用惯性矩表示) 愈大, 它的抗弯能力就愈大, 所以, 根据^[1]计算得到: 同样面积的框式梯形加压钢板的

例, 横断性骨折 17 例, 斜形骨折 13 例, 轻度粉碎性骨折 7 例, 新鲜骨折 28 例, 其它骨折 9 例。

2. 手术要点: 选 4mm 普通螺钉 4 个, 自制 5mm 加压螺钉 2 个, 手术基本按 AO 技术进行, 尽量少剥离骨膜, 以能将该钢板置入为原则。有骨片时, 尽量利用框中的横梁将骨片框住。拧螺钉时先固定钢板一侧, 然后将加压螺钉拧入加压孔, 最后将剩余的螺钉拧入。

治疗结果

21 例随访, 随访时间 3~28 个月, 平均 15 个月, 其中的 1 例重新外伤, 骨折断端形成折角, 但力线尚可。有一骨片脱落, 其余部位愈合良好。除上例外, 其它固定可



图 3 股骨多段粉碎性骨折及框式梯加压钢板固定后 X 片

靠 (如图 3) 20 天~3 个月外骨痂形成, 骨折线变模糊, 10 个月左右断端愈合坚固, 钢板摘除未发现 1 例有断钉拔钉现象, 也未发现在断端有重新骨折现象。

讨论

1. 框式梯形加压钢板是以半圆环的形式, 将股骨、胫骨等四肢骨折断端环包, 其抗弯模量是普通钢板的 5 倍左右, 所以, 它固定可靠、稳定性好。

2. 由于将二排 (6 个螺钉) 合理地分布在受剪应力的部位, 避免了受拉应力的作用, 从而有效地避免了普通钢板常出现的拔钉现象, 这种结构国内尚未见到类似报道。

3. 操作较简单, 虽然框式梯形钢板有两排螺钉孔, 但螺钉孔处于外侧和前内侧, 手术操作也不会增加不便。

存在的问题: 框式梯形加压钢板加工工艺要求较高, 一般需模具成型, 一般机加工, 费用较贵。(已获国家发明专利)

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全国“骨折复位固定器研究与临床应用”培训班招生启事

经卫生部科教司列为 1993 年 10 大重要科研成果向全国推广普及, 由中国民族医药学会主办的全国“骨折复位固定器研制与临床应用”培训班于 1995 年 4 月中旬在北京开班, 面向全国广大骨外科医师招生, 尤其欢迎基层单位的医务人员参加。孟和教授授课, 学习期满发给结业证书。学费 260 元, 食宿、交通费自理。(学会可安排食宿, 费用回单位报销。)

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Abstract of Original Articles

Clinical study on epiphyseal injury treated by integration of traditional Chinese and modern medicine

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A new classification of epiphyseal injury was suggested through clinical and X-ray analysis of nine positions in epiphyseal injury on extremities in 363 cases, in the meanwhile pathogenesis of epiphyseal injury, morphology, classification, treatment and prognosis etc. problems were clarified. A preliminary exploration of therapeutic theoretical basis and principles were made via a remote observation of 216 cases, the rate of therapeutic excellent and good with maneuver reduction and splint fixation was 91.1%. It was prominently superior than open reduction of which the efficacy was 71.9%. Integration of traditional Chinese and modern medicinal therapy fits to various age, position and kinds of most epiphyseal injuries.

Key words Epiphysis Trauma and injury

Integration of traditional Chinese and modern medicinal therapy

(Original article on page 5)

Multinuclear giant cells and osteoclasts in callus - histological and ultrastructural observation

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The morphology of multinuclear giant cells (MGC) and osteoclasts (Oc) in rabbit's radius callus had been observed by light microscopy and transmission electron microscopy. It showed that both MGC and Oc participated in bone resorption, but MGC mainly resorbed dead bone and bone chips through phagocytosis and extracellular degradation at the early stage of fracture healing, and Oc mostly resorbed calcified cartilaginous callus and new formed trabecular bone by extracellular resorption to accomplish the remodeling of callus. It is suggested that the filopods on the surface of MGC and ruffled border on the surface of Oc are closely related to extracellular degradation of bone mineral. Their difference in the mechanism of degradation is waiting or further study.

Key words Callus Histology Ultrastructure

(Original article on page 8)

Influence of ultrastructure of rabbit skeletal muscle mimic mountain-climbing myalgia treated with Yue Ji Ling lotion

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Exploration of the pathology of mountain-climbing myalgia and observation of therapeutic action of Yue Ji Ling Lotion on rabbit with over burden motion mimic human mountain-climbing action were carried out. The results indicated that the functional state of rabbit extremities is similar to human mountain-climbing myalgia and the ultrastructure of skeletal muscle showed prominent traumatic changes. Yue Ji Ling lotion bears the function of inhibition the traumatic changes effectively and restoration the normal function of the limbs as well.

Key words Skeletal muscular system Yue Ji Ling lotion Ultrastructure
(Original article on page 10)

Dr. Shi Weizhi's experience in treating cervical spondylotic myelopathy

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Old traditional Chinese medical doctor Shi Weizhi holds that the pathogenesis of cervical spondylotic myelopathy is due to insufficiency of liver and kidney, emptiness of Du meridian, blockade of the meridian due to wind-dampness, obstruction of flowing of Qi and blood. Better results were obtained after application of the therapeutic principles of invigorating the liver and kidney, warming the meridian, invigorating of Qi and activating of blood circulation, and expelling of wind and dredging the meridian passage.

Key word Cervical spondylosis Pathogenesis
Traditional Chinese medicinal therapy
(Original article on page 12)

Study and clinical application on frame-style ladder form enhanced steel plate

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Based on the principle of bio-mechanics and starting point on the stability of internal fixation, double arm frame-style ladder form enhanced steel plate was designed. The therapeutic effect was satisfactory after 37 cases had been used clinically. No one case of break wire, pulling out wire and refracture phenomenon on the fractured end was found during withdrawing the steel plate.

Key words Fracture fixation Frame-style ladder form enhanced steel plate
(Original article on page 27)