

'Intelligent' Implant Will Prevent Infection in Total Hip and Knee Replacements

By Marilyn Larkin

NEW YORK (Reuters Health) Jul 09 - An interdisciplinary group of surgeons, microbiologists, and engineers are developing an "intelligent" implant for hip or knee replacements that will be able to recognize signs of an incipient infection, diagnose the problem, treat itself, and report to a clinician what it has done. The project, now in early stages, was described in a presentation here at the American Society of Microbiology's Conference on Bio-, Micro-, and Nanosystems.

"When an artificial joint goes bad, it forms a biofilm that is extremely resistant to antibiotics," Dr. Garth D. Ehrlich of the Center for Genomic Sciences at the Allegheny Singer Research Institute in Pittsburgh, Pennsylvania, told conference attendees. "The only solution is to remove the device, but even then, there's no guarantee that the biofilm won't persist, and reinfect the replacement joint. If the second joint fails, the patient may need limb amputation."

The removal procedure itself is "traumatic," he emphasized, and often results in "additional bone loss, extensive soft tissue destruction, months of forced bed rest with IV antibiotics, and significant loss of quality of life," Dr. Ehrlich said. It is also costly--up to \$500,000 per procedure, he noted. Although only 2% to 3% of total joint replacements fail due to chronic biofilm infection, "this very traumatic event still affects 3500 to 4000 people a year in the United States."

Therefore, the interdisciplinary team is developing a replacement hip joint with microelectronic mechanical systems (MEMS)-based biosensors placed in multiple locations. "The MEMS sensors would detect quorum sensing and other early events that lead to biofilm formation, and immediately trigger the implant's

internal reservoirs to release anti-biofilm and anti-microbial compounds," Dr. Ehrlich explained.

A second class of biosensors would give feedback to ensure that therapeutic concentrations are achieved, and telemetry systems would permit external monitoring. Finally, the implanted device would need power. The team is investigating the use of a power supply that "runs off body processes," he said.

The first implant will feature MEMS sensors focused on *S. aureus* and *S. epidermitis*, which, he noted, are responsible for more than 90% of infected arthroplasties.

"The system will only work prophylactically," Dr. Ehrlich stressed. "Once biofilm forms, it's too late."

-ABSTRACT-

TITLE -THE REVOLUTIONARY TREATMENT OF FRACTURE OF TIBIA BY NEWLY DESIGNED DAGA INTERLOCKING NAIL BY MAKING THE PATIENTS TO BEAR WEIGHT ON THE DAY OF SURGERY WITHOUT I.I.T.V.

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800 cases of fracture of tibia have been treated by newly designed Daga interlocking nail with 98% rate of success.

The cross section of the nail is cloverleaf in through out its length. The lower end is tapering one so that it negotiates the distal fragment very well. There is slit of 3-4 mm at

posterior side thru' out its length so there is compressibility in transverse axis So as to negotiating at isthmus & lower end without causing any splintering of the bone at all which does occur in other interlocking nails which have rather blunt lower end. There is D shaped head at the top which acts like beam over two walls of nail & which absorbs all blows of hammer during operation & takes the weight during weight bearing & releases all stress & strain over the walls of nail so there is least chances of pathological bending or breaking of nail inspire of immediate weight bearing. The incidence of pathological bending or breaking of nail is only 2% as against universal rate of 6% in all other interlocking nails[no weight bearing till 3 weeks]There is one hole in the upper eye which is there for accommodation of extracting hook which is for accommodation of cortical screw for interlocking purpose & prevention of rotation. There is one more eye in the distal part[2.5cm proximal lower end]

For accommodation of lower interlocking cortical screw. The simple corical Screw are used for interlocking purposes[4.5mm for 9mm & 10 mm nails & 3.5 mm for 8mm nails]There is no need of using special bolts which are quite costly & no need of 3-4 screws or bolts. If there are more holes then the nail becomes weak. The bending force of this nail is 52kg per esq. as against other nails which have 42 kg per sq cam's each Daga nail does bear 175 to 180 kg weight before bending[by calculation]The basic material used is SMO 316L which is non corrosive & non reactive.

As pre new concept this implant is optimum strong with optimum resiliency So that while progressing this nail thru' medullary cavity of given tibia it takes the shape of that cavity & there are least chances of breaking or more bending.

Due to its compressibility in transverse axis 9mm diameter nail can very negotiates where other nails of 9mm does not negotiate well & one has select lesser diameter nail of other type.

Due to immediate weight bearing there is compression at fracture site which stimulates neoosteogenesis which leads to early union & this is seen early disappearance of pain at fracture site within 8-10 days. Many patients have started driving motor cycles or cars just within 15-17 days after operation. Many patients have resumed their duties just within one month including driving too. Which prevents loss of working hours of patient & thus helps in National economy. There is incidence of tibial fractures per

annum in India is to the tune of 800000-900000 & one can imagine how severe is the loss of working hours of these workers if they do not start working again early.

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The union period with Daga nailing is 8-10 weeks as against 14-18 weeks with all other interlocking nails. Due to early weight bearing few deformities have been corrected such as TA contractor etc Otherwise one would be subjected to other operations for correction of deformity thus preventing physical handicappedness which would have occurred otherwise.

Till date apprx 18 dissertations have been written. Approved & appreciated at different universities of India. Apprx. 60-65 workshops with operative demonstrations have been organized & carried out with great success. Apprx. more than 2000 orthopaedic surgeons have shown this technique. Few articles have been presented & published so far on Daga interlocking nail & few have won prizes.

Few mutilated limbs have been saved due to this technique at Kota [Rajstan] center.

Even the operative time is also very much less compared to all other similar methods.

This method proved to be excellent for tibial fractures in last earth quake of 1993 of latur & now recently at Gujrat where the patients were walking next day of operation. Which they never thought that this would happen so fast.

So the results of this method are convincing, encouraging & enthusiastic as this method proved to very economic. easy, simple, minimum traumatizing technique & the patients can be discharged very fast & early/So the expenditure to the patient gets reduced considerably & to the institutes Govt. & Charitable as the patients are sent home earlier & there is moral boosting of the patient.