VOLUME 11, ISSUE 40 | DECEMBER 22, 2015

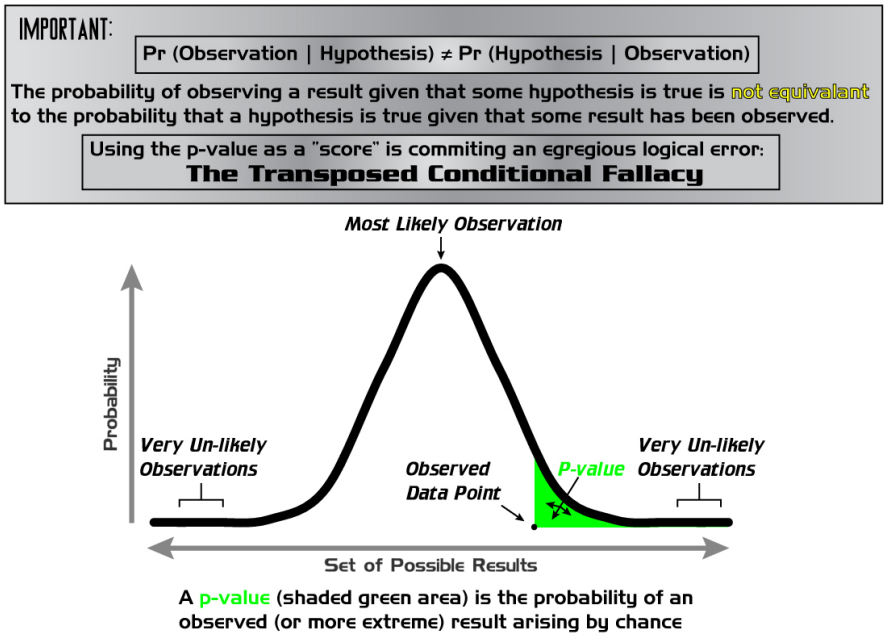
Orthopedics This Week

WEEK IN REVIEW

4 Dump the 'P' Value >> Can you define 'P-Value?" If you're stumped, you are in very good company. Top scientists struggle with that one. Yet 'P-Value' is the critical gating item for published research. Is it time to dump the 'P-Value?' Some top journals and scientists say "yes."

10 XTANT, SeaSpine and RTI Surgical: Blending Biologics and Hardware >> Three talented and experienced CEOs, Dan Goldberger, Keith Valentine and Brian Hutchison are putting together a new model for blending biologics and hardware in spine. Will they create the next group of great spine companies? One thing is for sure—the winners will be spine and neuro-surgeons.

14 Spine Surgeons Pleading Guilty in Spinal Cap Investigation >> The initial subjects of California's "Spinal Cap" investigation promised to sing. Now federal prosecutors are reaching guilty pleas with surgeons and other providers who funneled patients into the scheme in return for illegal kickbacks. Here's the scoop from the latest unsealed court documents.



18 Profile: C. Lowry Barnes, M.D. >> C. Lowry Barnes, M.D., Chairman of Orthopaedics and also the Carl L. Nelson, M.D. Chair in Orthopaedic Surgery at the University of Arkansas for Medical Sciences, talks about his transition from private practice, and how UAMS Orthopaedics is growing by leaps and bounds.

BREAKING NEWS

22 **FDA Gives Up** Off-Label Fight With Pacira

23 **FDA Approves** New Uses for **Infuse**

24 Antibody Treatment Could Reduce **Amputations in OS Patients**

26 Docs Provide **Free Implants** in Kentucky

27 **10% Weight Loss** = 56% Less Cartilage Degeneration

28 **New** Screw-Less, Rod-Less **Spine Fusion Device** From Australia

For all news that is ortho, read on.

Orthopedic Power Rankings

Robin Young's Entirely Subjective Ordering of Public Orthopedic Companies

THIS WEEK: A very important and timely report emerged on the 14th of December from BMO Capital markets and its head of the medical technology group—Joanne Wuensch. In the 192 page report Wuensch and her team dissected and analyzed the multiple regulatory, market, demographic and financial pressures that are determining the future of orthopedics. Their conclusions? Expected hip and knee sales growth rates need to moderate. Spine is likely to consolidate. And, in terms of valuation, orthopedic equities are at or close to their peak.

RANK	LAST WEEK	COMPANY	TTM OP MARGIN	30-DAY PRICE CHANGE	COMMENT
1	4	Integra LifeSciences	13.74%	3.64%	Investors are buying into CEO Arduini's vision—which, among other things, are pushing profit margins higher. New #1.
2	1	Stryker	22.94	(5.93)	BMO's report helped, we suspect, the ortho sell off. Still, we note that SYK's free cash flow is equal to its total debt. Time to spend?
3	1	Zimmer Biomet	31.22	(5.73)	The two most visible large integrated ortho companies are SYK and ZBH and they bore the brunt of the end of year sell off.
4	3	Medtronic	27.92	(1.61)	Medtronic spine, with 31% of the spine market, is #1 and, interestingly, has clear room to grow in terms of product innovation.
5	8	ConMed	11.10	0.76	ConMed's SurgiQuest acquisition supports the narrative that CNMD is indeed is evolving into a more dynamic, growth oriented company.
6	5	Globus Medical	30.19	3.33	Fastest revenue growth rate with the highest operating profit margins among the spine market leaders.
7	6	Orthofix	2.35	(0.90)	Year-over-year comps for this next couple of quarters should be excellent—say a consensus of Wall Street analysts.
8	9	Exactech	10.26	2.67	EXAC is the 2nd least expensive equity in ortho and over the past 30 days has attracted new institutional buyers.
9	NR	Smith & Nephew	19.66	2.61	Smith & Nephew was not included in the overall large ortho sell off this past month. Buying Blue Belt is why.
10	NR	RTI Surgical	8.47	0.26	RTI Surgical is now officially ridiculously cheap. Most analysts are looking for strong EPS gains this year and next.

Robin Young's Orthopedic Universe

TOP PERFORMERS LAST 30 DAYS

	COMPANY	SYMBOL	PRICE	MKT CAP	30-DAY CHG
1	MiMedx Group	MDXG	$9.54	$1,040	14.11%
2	SeaSpine Hldgs Corp.	SPNE	$16.11	$179	9.89%
3	Integra LifeSciences	IART	$66.36	$2,454	3.64%
4	Globus Medical	GMED	$27.02	$2,573	3.33%
5	Wright Med. Grp N.V	WMGI	$22.64	$2,324	2.68%
6	Exactech	EXAC	$17.70	$249	2.67%
7	Smith & Nephew	SNN	$34.95	$15,661	2.61%
8	ConMed	CNMD	$42.60	$1,180	0.76%
9	MicroPort Scientific	853	$0.41	$588	0.60%
10	RTI Biologics Inc.	RTIX	$3.79	$219	0.26%

WORST PERFORMERS LAST 30 DAYS

	COMPANY	SYMBOL	PRICE	MKT CAP	30-DAY CHG
1	Xtant Medical Hldgs	XTNT	$2.39	$28	-17.59%
2	Aurora Spine	ASG	$0.16	$3	-8.53%
3	Stryker	SYK	$91.26	$34,270	-5.93%
4	Zimmer Biomet	ZBH	$98.96	$20,166	-5.73%
5	LDR Holding Corp.	LDRH	$24.02	$698	-2.87%
6	K2M Group Hldgs	KTWO	$19.35	$798	-2.71%
7	Medtronic	MDT	$76.31	$107,304	-1.61%
8	CryoLife	CRY	$10.26	$292	-1.44%
9	Orthofix	OFIX	$38.48	$727	-0.90%
10	TiGenix	TIG.BR	$0.99	$176	-0.86%

LOWEST PRICE / EARNINGS RATIO (TTM)

	COMPANY	SYMBOL	PRICE	MKT CAP	P/E
1	Exactech	EXAC	$17.70	$249	15.91
2	Johnson & Johnson	JNJ	$101.95	$282,090	17.77
3	RTI Biologics Inc.	RTIX	$3.79	$219	19.18
4	Zimmer Biomet	ZBH	$98.96	$20,166	19.58
5	Stryker	SYK	$91.26	$34,270	19.81

HIGHEST PRICE / EARNINGS RATIO (TTM)

	COMPANY	SYMBOL	PRICE	MKT CAP	P/E
1	CryoLife	CRY	$10.26	$292	67.32
2	NuVasive	NUVA	$51.76	$2,541	59.42
3	MiMedx Group	MDXG	$9.54	$1,040	53.00
4	Smith & Nephew	SNN	$34.95	$15,661	31.26
5	Integra LifeSciences	IART	$66.36	$2,454	29.17

LOWEST P/E TO GROWTH RATIO (EARNINGS ESTIMATES)

	COMPANY	SYMBOL	PRICE	MKT CAP	PEG
1	RTI Biologics Inc.	RTIX	$3.79	$219	1.28
2	Globus Medical	GMED	$27.02	$2,573	1.63
3	Exactech	EXAC	$17.70	$249	1.79
4	Zimmer Biomet	ZBH	$98.96	$20,166	1.94
5	Smith & Nephew	SNN	$34.95	$15,661	2.03

HIGHEST P/E TO GROWTH RATIO (EARNINGS ESTIMATES)

	COMPANY	SYMBOL	PRICE	MKT CAP	PEG
1	NuVasive	NUVA	$51.76	$2,541	3.89
2	Medtronic	MDT	$76.31	$107,304	3.83
3	MiMedx Group	MDXG	$9.54	$1,040	3.53
4	Johnson & Johnson	JNJ	$101.95	$282,090	3.31
5	Integra LifeSciences	IART	$66.36	$2,454	2.58

LOWEST PRICE TO SALES RATIO (TTM)

	COMPANY	SYMBOL	PRICE	MKT CAP	PSR
1	Alphatec Holdings	ATEC	$0.22	$22	0.11
2	Xtant Medical Hldgs	XTNT	$2.39	$28	0.80
3	RTI Biologics Inc.	RTIX	$3.79	$219	0.83
4	Exactech	EXAC	$17.70	$249	1.00
5	SeaSpine Hldgs Corp.	SPNE	$16.11	$179	1.29

HIGHEST PRICE TO SALES RATIO (TTM)

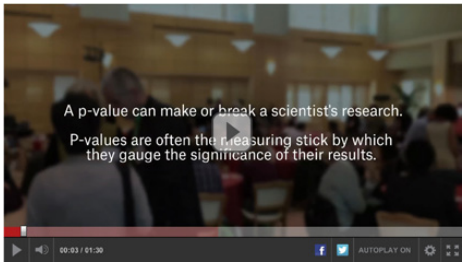
	COMPANY	SYMBOL	PRICE	MKT CAP	PSR
1	TiGenix	TIG.BR	$0.99	$176	27.97
2	MiMedx Group	MDXG	$9.54	$1,040	8.79
3	Wright Med. Grp N.V	WMGI	$22.64	$2,324	6.74
4	Globus Medical	GMED	$27.02	$2,573	5.42
5	Medtronic	MDT	$76.31	$107,304	5.30

PSR: Aggregate current market capitalization divided by aggregate sales and the calculation excluded the companies for which sales figures are not available.

Dump the 'P' Value

BY ROBIN YOUNG

Who says statistics aren't funny? Watch top scientists try to define 'P Value.'



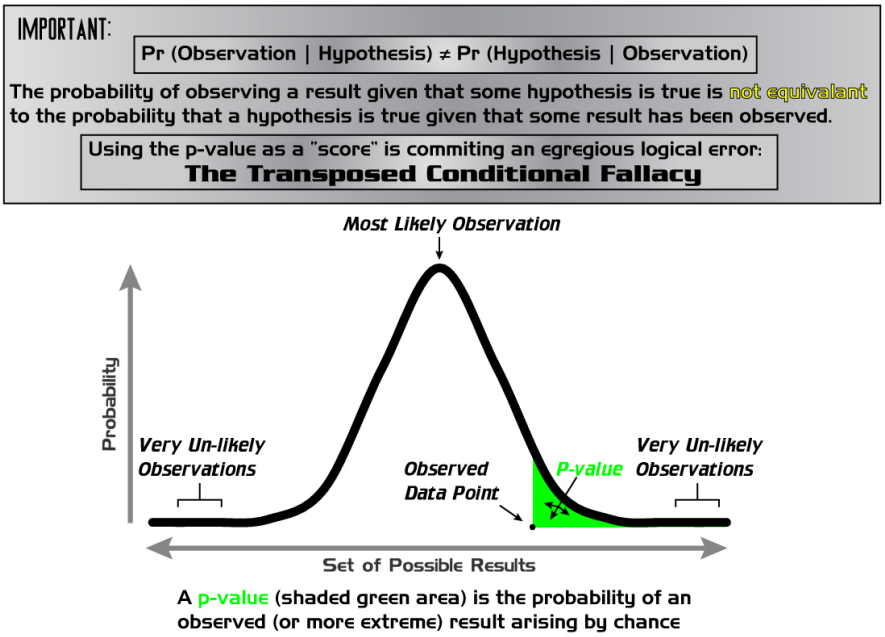
www.fivethirtyeight.com and Christie Aschwanden

This video was taken by Christie Aschwanden, the science editor for the statistical analysis site, fivethirtyeight.com while attending the METRICS conference at Stanford University. The conference brought together many of the world's top experts on meta-science, or the study of studies.

She asked these top statisticians to define 'P-Value'—arguably the single most powerful statistic in all of published research. Each time she asked the question, the brains of these folks started to heat up, the gears start clanging and more often than not, they broke down laughing.

They could not do it. It's hilarious to watch.

Steve Goodman, M.D., MHS, Ph.D., Associate Dean of Clinical and Translational Research and Professor of Medicine and Health Research and Policy at Stanford University, said on camera: "Well, I've actually spent my entire career about the definition of 'P-Value' but I cannot tell you what it means and almost nobody can."



pValue Graph / Source: Wikimedia Commons and Repaptilito

If these top scientists struggle to define 'P-Value', what hope does the rank and file surgeon have?

Ticket to Publish

For the record, the definition of 'P-Value' is: "The level of marginal significance within a statistical hypothesis test, representing the probability of the occurrence of a given event."

In plain English: P-Value is the difference between your hypothesis and the devil's advocate's hypothesis—when the devil's advocate is saying that your treatment is no better than the control treatment.

But in research's back alleys 'P-Value' is something else. It's your ticket to be published in a peer-reviewed journal.

'P-Value' and Clinically Relevant Information: Two Ships Passing in the Night

So you want to be published in a peer-reviewed journal? OK. Your 'P-Value' needs to be <0.05. If it is higher, you're probably toast.

A 'P-Value' of <0.05 means that if your treatment had no effect, you'd obtain the observed difference or more in less than 5% of the studies due to random sampling error.

But don't worry. There are many techniques which can ensure your 'P-Value' passes muster. Here's a game you can play which illustrates this point. http://53eig.ht/HackingScience

In this game, you are asked to pick which political party—Republican or

Democrat—is better for the economy. You have ten variables to choose from. Choose at least two.

There are 1,800 possible variations of the ten data sets to choose from in this game and 1,078 will give your study a 'P-Value' of less than 0.05 and therefore your study is PUBLISHABLE.

If at first you don't succeed (your 'P-Value" is over 0.05 and is, therefore, UNPUBLISHABLE) try a different combination of data sets. In no time at all, you get the 'P-Value' of your dreams—and therefore can publish, get tenure, and so forth.

All you have to do is find the right data sets.

Answers vs. Results

If 'P-Value' can be dialed in by selecting which data sets to use in a study, are we not essentially seeking results rather than clinically relevant answers?

One peer-review journal has apparently pondered that question and decided to ban all Null Hypothesis Significance Testing Protocol measures—like 'P-Value'—from their journal.

In February 2015 the editors of *Basic and Applied Social Psychology* announced that they will no longer publish 'P-Values.'

The editors, David Trafimow, Ph.D. and Michael Marks, Ph.D. (Dr. Trafimow is Professor of Psychology and Dr. Marks is Associate Professor of Psychology at New Mexico State University) wrote:

> "Confidence intervals suffer from an inverse inference problem that is not very different from that suffered by Null Hypothesis Significance Testing Protocol (NHSTP—such as *p*-values, *t*-values or *F*-values, statements about "significant" differences or lack thereof, and so on). In the NHSTP, the problem is in traversing the distance from the probability of the finding, given the null hypothesis, to the probability of the null hypothesis, given the finding. Regarding confidence intervals, the problem is that, for example, a 95% confidence interval does not indicate that the parameter of interest has a 95% probability of being within the interval. Rather, it means merely a strong case of rejecting it. Confidence intervals do not provide a strong case for concluding that the population parameter of interest is likely to be within the stated interval. Therefore, confidence intervals also are banned from *BASP* (*Basic and Applied Social Psychology*)."

Garbage In, Garbage Out

What the *BASP* journal editors were saying, in effect, is 'garbage in, garbage

out.' If the 'null hypothesis' is garbage, then your study is garbage given a low 'P-Value.' 'P-Value' is being used to give context and legitimacy to studies. But the context it offers is not helpful if the goal is to deliver new information and answers to clinical problems.

What works better? According to the editors of *BASP,* "Instead of p-values, the journal will require strong descriptive statistics, including effect sizes."

Brian Nosek, co-founder and executive director of the Center for Open Science said, in Christie Aschwanden's excellent article titled 'Science Isn't Broken': "Science operates as a procedure of uncertainty reduction. The goal is to get less wrong over time."

So every clinical study has in it a temporary truth which itself is built on earlier research. This is an iterative process. Science works when everyone is standing on the shoulders of those who came before.

And for those who do try to stand on the shoulders of those who came before, they learn that science is difficult. It takes time and lots of iterative steps by lots of investigators to get to 'truth.' (See the *Fingerprint of God* article from September 25, 2015).

The InFuse Research Example

We think we saw this in action when we analyzed early Infuse BMP utilization data.

In the early years—2005 to 2009—the pace of clinical studies regarding the use of BMP2 accelerated dramatically. While *The Spine Journal* in its infamous June 2011 BMP issue focused on just 13 early studies, the reality is that there were hundreds of studies presented at various venues in those five years (see the table at the end of this article for a selection).

When we look at data from the 582,135 spine fusion cases during those years which had been coded as having used BMP2 and compare the complication rates to 619,106 spine fusion cases which excised bone for grafting instead of using BMP2, we think we can detect a change in surgeon behavior over those five years.

The following table presents U.S. procedure volumes for insertion of bone morphogenic protein (ICD-9 code 84.52 and CPT code 22851) and the associated complication rates for patients under 65 and then for patients over 65. This data is processed by PearlDiver and was collected from the Medicare Standard Analytical File, the Medicare Carrier File and the National Inpatient Sample. *(See table below.)*

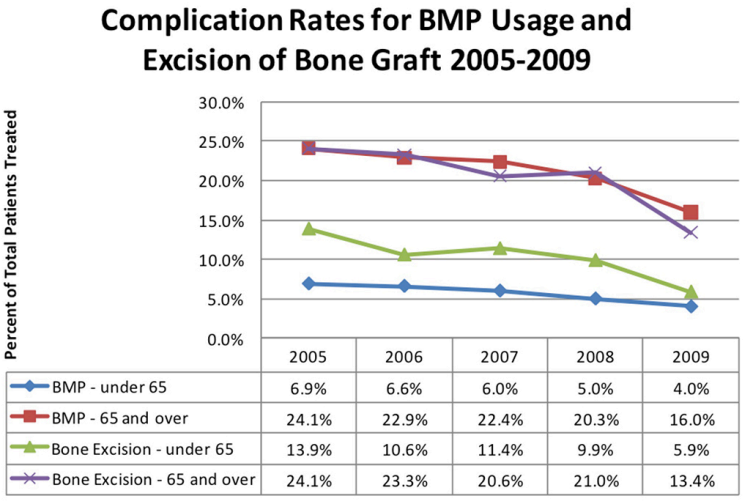
	2005	2006	2007	2008	2009
U.S. Volume of BMP Spine Cases	85,833	108,843	120,688	128,915	137,856
Volume under age 65	52,364	66,938	**73,493**	**83,675**	**89,478**
Volume age 65 or older	33,469	41,905	**47,195**	**45,240**	**48,378**
Total patient complications	11,701	13,983	**14,993**	**13,414**	**11,284**
All ages complication rate	**13.6%**	**12.8%**	**12.4%**	**10.4%**	**8.2%**
Under age 65 complications (distinct patients)	3,639	4,385	4,408	4,210	3,542
Under 65 complication rate	**6.9%**	**6.6%**	**6.0%**	**5.0%**	**4.0%**
Age 65 and older patient complications (distinct patients)	8,063	9,598	10,585	9,204	7,742
65 and over complication rate	**24.1%**	**22.9%**	**22.4%**	**20.3%**	**16.0%**
Total patient refusions	5,227	5,766	**6,372**	**5,772**	**5,928**
All ages refusion rate	**6.1%**	**5.3%**	**5.3%**	**4.5%**	**4.3%**
Under age 65 refusions	1,580	1,595	2,027	1,878	1,929
Refusion rate	3.0%	2.4%	2.8%	2.2%	2.2%
Age 65 or older refusions	3,647	4,171	***4,345***	***3,894***	***3,999***
Refusion rate	10.9%	10.0%	9.2%	8.6%	8.3%

Source: PearlDiver Technologies, Inc./Scott Ellison, Senior Analyst

Here's the same analysis for bone graft harvesting (ICD-9 code 77.59). *(See table at the bottom of the page.)*

What this data shows is that complication rates have declined consistently over those early BMP years. For this analysis, PearlDiver's analyst, Scott Ellison, looked at a wide range of complications.

Did complications decline because spine surgeons were changing their use of InFuse based on both personal experience and clinical papers? Or was the decline due to other factors?



Source: PearlDiver Technologies, Inc./Scott Ellison, Senior Analyst

We think the surgeons were walking up a learning curve by reading the studies, listening to podium talks and learning from their own experience.

The scientific truth of using BMP in patients was revealed through a pattern of iterative experiences and studies.

It is **science** as it is meant to work and, if peer-review journal editors will allow, it can work.

Dump the 'P-Value'

Criticizing 'P-Value' is not really a very courageous stand to take these days. As the video at the top of this article illustrated, it's already under serious challenge from many corners of the scientific community. The obvious question, really, is what to put in its place?

There are lots of suggestions in the statistics blogosphere—more descriptive statistics or Bayesian approaches, for example.

But, it would be very interesting to see how orthopedic journal editors would tackle the shortcomings of the all-powerful 'P-Value' and what kinds of fresh ideas they would bring to represent and synthesize clinical evidence in their publications.

Answers, in other words, not just results.

	2005	2006	2007	2008	2009
U.S. Volume of Excision of Other Bone for Graft, Except Facial Bones	103,431	90,761	97,945	156,398	170,571
Volume under age 65	74,714	64,468	**68,779**	**110,828**	**120,871**
Volume age 65 or older	28,717	26,293	**29,166**	**45,570**	**49,700**
Total patient complications	17,281	12,975	**13,803**	**20,493**	**13,822**
All ages complication rate	**16.7%**	**14.3%**	**14.1%**	**13.1%**	**8.1%**
Under Age 65 complications (distinct patients)	10,374	6,856	7,808	10,935	7,155
Under 65 complication rate	**13.9%**	**10.6%**	**11.4%**	**9.9%**	**5.9%**
Age 65 and older patient complications (distinct patients)	6,907	6,119	5,995	9,558	6,668
65 and over complication rate	**24.1%**	**23.3%**	**20.6%**	**21.0%**	**13.4%**
Refusion rate	10.9%	10.0%	9.2%	8.6%	8.3%

Source: PearlDiver Technologies, Inc./Scott Ellison, Senior Analyst

Early BMP2 Studies:

Bone Morphogenic Proteins – A Partial List of the Peer Review Articles Which Highlighted Complication Rates 2006 - 2011				
Article Title	**Year**	**Journal**	**Cited by**	**Authors**
Adverse effects associated with high-dose recombinant human bone morphogenetic protein-2 use in anterior cervical spine fusion	2006	SPINE	149	LBE Shields GH Raque SD Glassman
Complications of anterior cervical discectomy and fusion using recombinant human bone morphogenetic protein-2	007	European Spine Journal	72	R Vaidya J Carp A Sethi S Bartol J Craig
Neurologic impairment from ectopic bone in the lumbar canal: a potential complication of off-label PLIF/TLIF use of bone morphogenetic protein-2 (BMP-2)	2008	The Spine Journal	70	DA Wong A Kumar S Jatana G Ghiselli
Adverse swelling associated with use of rh-BMP-2 in anterior cervical discectomy and fusion: a case study	2007	The Spine Journal	68	B Perri M Cooper C Lauryssen
Vertebral bone resorption after transforaminal lumbar interbody fusion with bone morphogenetic protein (rhBMP-2	2006	Journal of Spinal Disorders and Techniques	62	JW McClellan DS Mulconrey
Prevalence, complications, and hospital charges associated with use of bone-morphogenetic proteins in spinal fusion procedures	2009	JAMA	53	KS Cahill JH Chi A Day
Vertebral osteolysis after posterior interbody lumbar fusion with recombinant human bone morphogenetic protein 2: a report of five cases	2007	The Spine Journal	48	KU Lewandrowski C Nanson
Complications in the use of rhBMP-2 in PEEK cages for interbody spinal fusions	2008	Journal of Spinal Disorders and Techniques	43	R Vaidya A Sethi S Bartol
A comprehensive review of the safety profile of bone morphogenetic protein in spine surgery	2008	Neurosurgery	40	D Benglis MY Wang
The perioperative cost of Infuse bone graft in posterolateral lumbar spine fusion	2008	The Spine Journal	39	SD Glassman LY Carreon MJ Campbell
Complications associated with single-level transforaminal lumbar interbody fusion	2009	The Spine Journal	34	JA Rihn R Patel J Makda J Hong DG Anderson
The safety and efficacy of anterior cervical discectomy and fusion with polyetheretherketone spacer and recombinant human bone morphogenetic protein–2: a review …	2008	Journal of Neurosurgery	26	LM Tumialán J Pan GE Rodts Jr
A case of psoas ossification from the use of BMP-2 for posterolateral fusion at L4-L5	2008	SPINE	18	RS Brower
Adverse events in patients re-exposed to bone morphogenetic protein for spine surgery	2008	SPINE	18	LY Carreon SD Glassman DC Brock JR Dimar
RhBMP-2 versus iliac crest bone graft for lumbar spine fusion in patients over 60 years of age: a cost-utility study	2009	SPINE	18	LY Carreon SD Glassman M Djurasovic
Heterotopic ossification after the use of commercially available recombinant human bone morphogenetic proteins in four patients.	2008	The Journal of Bone	16	TW Axelrad B Steen DW Lowenberg
Perioperative complications of recombinant human bone morphogenetic protein-2 on an absorbable collagen sponge versus iliac crest bone graft for posterior …	2007	European Spine Journal	16	CH Crawford III LY Carreon MD McGinnis

…Continued on page 9.

Symptomatic ectopic bone formation after off-label use of recombinant human bone morphogenetic protein-2 in transforaminal lumbar interbody fusion	2010	SPINE	13	NF Chen ZA Smith E Stiner S Armin
A cost analysis of treatment of tibial fracture nonunion by bone grafting or bone morphogenetic protein-7	2009	International Orthopaedics	13	Z Dahabreh GM Calori NK Kanakaris
Recombinant human bone morphogenetic protein-2-induced radiculitis in elective minimally invasive transforaminal lumbar interbody fusions: a series review	2009	SPINE	12	SA Mindea P Shih
Complications of recombinant human BMP-2 for treating complex tibial plateau fractures: a preliminary report	2009	Clinical Orthopedics and Related Research	11	S Boraiah O Paul D Hawkes M Wickham
Is it safe to use recombinant human bone morphogenetic protein in posterior cervical fusion?	2009	SPINE	8	GK Hiremath MP Steinmetz
High-dose bone morphogenetic protein-induced ectopic abdomen bone growth	2010	The Spine Journal	6	H Deutsch
Formation of painful seroma and edema after the use of recombinant human bone morphogenetic protein-2 in posterolateral lumbar spine fusions	2010	Neurosurgery	6	MP Garrett UK Kakarla RW Porter
Promoting fusion in minimally invasive lumbar interbody stabilization with low-dose bone morphogenic protein-2--but what is the cost?	2010	The Spine Journal	5	RJ Mannion AM Nowitzke
Histopathologic inflammatory response induced by recombinant bone morphogenetic protein-2 causing radiculopathy after transforaminal lumbar interbody fusion	2010	The Spine Journal	5	RD Muchow WK Hsu
Complications associated with the use of bone morphogenetic protein in pediatric patients	2010	Journal of Pediatric Orthopedics	4	ME OETGEN
…mediated inflammatory reaction following posterior cervical decompression and fusion associated with recombinant human bone morphogenetic protein-2: a case…	2010	SPINE	3	BN Robin CD Chaput S Zeitouni MD Rahm
Use of Bone Morphogenetic Proteins in Spinal Fusion Surgery for Older Adults with Lumbar Stenosis: Trends, Complications, Repeat Surgery, and Charges	2011	SPINE	1	RA Deyo A Ching L Matsen BI Martin W Kreuter
Complications with recombinant human bone morphogenetic protein-2 in posterolateral spine fusion associated with a dural tear	2010	The Spine Journal	1	SD Glassman JL Gum CH Crawford III
Administration of Human Recombinant Bone Morphogenetic Protein-2 for Spine Fusion May Be Associated With Transient Postoperative Renal Insufficiency	2010	SPINE	0	JM Latzman L Kong C Liu
Delayed Pleural Effusion After Anterior Thoracic Spinal Fusion Using Bone Morphogenetic Protein-2	2011	SPINE	0	CK Kepler RC Huang D Meredith M Cunningham
Radiographic and CT Evaluation of Recombinant Human Bone Morphogenetic Protein-2-Assisted Spinal Interbody Fusion	2011	American Journal of Roentgenology	0	A Sethi J Craig S Bartol W Chen
Use of recombinant human bone morphogenetic protein-2 as an adjunct for instrumented posterior arthrodesis in the occipital cervical region: An analysis of…	2010	Junction and Spine	0	DK Hamilton JS Smith DL Reames

XTANT, SeaSpine and RTI Surgical: Blending Biologics and Hardware

BY ROBIN YOUNG

Mid-October in one of McCormick Center's cavernous halls sat Dan Goldberger in his Bacterin—soon to be named XTANT Medical Holdings, Inc.—booth at the North American Spine Society (NASS) Annual Meeting.

About 200 feet away was Brian Hutchison, CEO of RTI Surgical, Inc., in a booth roughly twice the size of Dan's booth. Maybe 150 feet away was Keith Valentine, CEO of SeaSpine, Inc., in a booth four times larger than Dan's.

Dan's XTANT is putting up annual sales of around $75 million. Keith's SeaSpine is about twice that at $130 million. And Brian's RTI Surgical is about double that at $270 million.

Of the three companies, Brian's is the most valuable at a market value of $270 million followed by Keith's at $135 million and Dan's at $35 million.

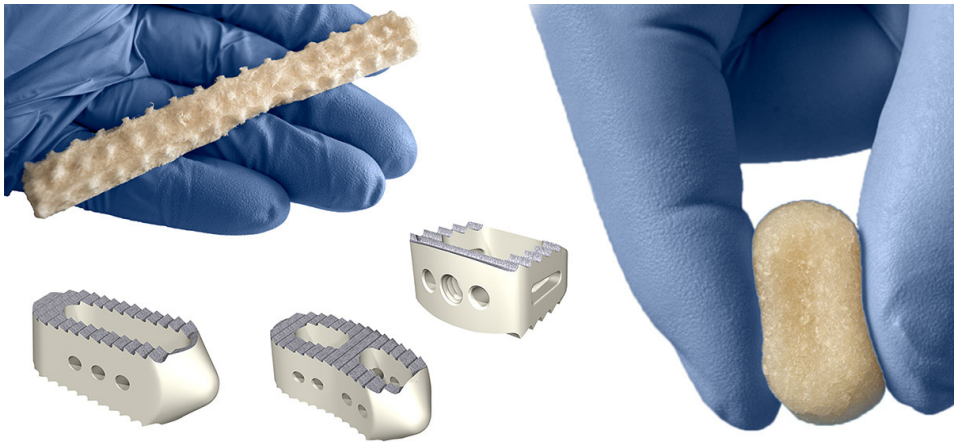
On a market value to sales basis (PSR), Dan's at the bottom of the group. His PSR is 0.5x. The other two companies are at about 1.0x.

All three companies are hoping to use biologics to differentiate their catalog of product offerings. And all three companies are run by talented, accomplished CEOs. Only one, however, is run by a newcomer.

A newcomer with fresh perspectives.

Dan Goldberger

Goldberger, who is 57 years old, is the CEO of XTANT, formerly Bacterin, a Montana company that is bucking conventional wisdom in the $10 billion spinal implant industry.



Courtesy of XTANT

The last company he led grew from $15 million in annual sales to more than $300 million in six years. Then he sold it to Versant for beaucoup dollars in 2013.

He recently told Wall Street that he thinks XTANT can put up $100-105 million in sales for 2016 and report EBITDA of between $7-9 million.

The year before he joined Bacterin the company reported $32 million in sales. If he delivers on his guidance, he'll have tripled sales in just three years. And he will have done it with both organic growth and the merger with X-Spine.

It is also noteworthy that Goldberger's first act after he joined Bacterin in 2013 was to reduce full time employment from 177 to 128. Sales still rose. The average revenue per employee rose 39% in his first year.

Goldberger, by the way, is a named inventor on more than 60 U.S. patents. His BS in Mechanical Engineering comes from the Massachusetts Institute of Technology. His MS in Mechanical Engineering is from Stanford University.

This is a smart guy.

Biologics as a Differentiation Strategy in Spine

A central strategy of XTANT, SeaSpine and RTI Surgical is to use biologics to differentiate themselves in spine.

Biologic products are integral to spinal fusion surgery. When a spine surgeon wants to provide a foundation and, potentially, a stimulating environment to grow new bone, a biologic material is required. If the surgeon goes the autograft route, then the OR team performs a second surgery to harvest bone from, typically, the iliac crest. This second surgery increases the cost of the primary procedure and raises several compli-

cations including increased post-operative pain and the risk of infection.

At least as common as harvesting the patient's own bone, is using cadaveric bone (allograft) either as a material to blend with the patient's own bone or as a substitute for it. Beyond simple allograft, surgeons can use more osteogenic materials like bone morphogenic proteins (BMP) or cellular allograft matrices.

Altogether, biologic materials like cadaveric bone materials or BMPs or cellular allografts are supplied by every spinal implant company including all of the industry's largest suppliers—Medtronic plc, DePuy Synthes, Stryker Corporation, NuVasive, Inc. and Globus Medical, Inc..

In total, biologic products as adjunct to spinal surgery generates more than $3 billion a year in sales for these companies.

For most spine surgeons, biologic products are not highly differentiated from company to company—particularly cadaveric bone products. "Most docs think they're all the same," said Stephen Hochschuler, M.D, co-founder and chairman of the board of the Texas Back Institute and one of the most prolific clinical study and podium presenters in the spine surgeon community. But, Dr. Hochschuler was quick to point out—it is an incorrect assumption. Biologic products have been improving consistently since demineralized bone was first introduced in the 1980s and there are many strong biologic products on the market.

Furthermore, biologic products like Medtronic's InFuse, Cerapedics, Inc.'s i-Factor, Wright Medical's Augment or the cellular allograft matrices like NuVasive's Osteocel, Orthofix's Trinity or DePuy's ViviGen are highly differentiated.

Can a Biologics Company Turn Into a Spine Company?

Keith Valentine, who was one of the three key executives who built NuVasive into a $2.5 billion market cap spinal implant company, came to SeaSpine because it offered a biologics platform to build on.

In June, Valentine told us that 50% of SeaSpine's sales come from biologic products. Those sales increased in 2014. By contrast, SeaSpine's hardware sales declined and that pulled overall revenues down.

Biologics accounted for $67 million of SeaSpine's 2014 sales which means that, in terms of market share, SeaSpine biologics was punching above its weight. In the bone graft market, SeaSpine holds an 8.6% share. In the demineralized bone market, SeaSpine has a 12.3% share.

By contrast, SeaSpine's spine hardware business holds barely a 1% share of the global spinal hardware business.

Valentine's central objective is to leverage that biologic footprint with a couple of new technologies and a pipeline of MIS (minimally invasive surgery), adult deformity and degenerative disc disease (DDD) hardware products.

To put this in perspective, if SeaSpine had the same market share in hardware that they have in biologics, they'd be as large as NuVasive.

And in every spine case, biologics and hardware go hand in hand.

Brian Hutchison, CEO of RTI Surgical made a similar argument when he acquired Pioneer Surgical Technology in June 2013. "The transaction will enhance RTI's existing core competency in biologics processing with the addition of Pioneer's core competency in metals and synthetics."

At the time of the purchase, RTI's biologic sales were 100%of their business. At the end of 2014, metal and synthetic spinal implants had become 33% of the business and biologics products were 63%. For the first nine months of 2015, metal and synthetics had grown to 35% of total revenue and biologics were 60%.

And yet…both RTI Surgical and SeaSpine are trading at about 1.0x sales and XTANT is trading at 0.5x sales. The average price-to-sales for the other suppliers of spinal implants is 3.23x.

Which comes first, biologics or hardware?

Based on the current valuations, Wall Street is still waiting for that break-out biologically driven spine company.

Goldberger at XTANT, Valentine at SeaSpine, and Hutchison at RTI each have a strategy to be that company.

The most successful biologic product in the history of spinal implant sales is Medtronic's Infuse—which this year appears poised to generate approximately $550 million in sales.

Infuse is popular because it affirmatively grows bone and its body of clinical evidence is second to none. It is the biologic gold standard.

But did Infuse drive hardware sales for Medtronic spine?

Here's the data: *(See graph below.)*

On the surface, Medtronic's spine hardware, biologics and Kyphon sales appear pretty steady over the past six years.

But when we look at year-to-year percent change, two basic trends pop out:

1. Hardware/biologics/Kyphon are very loosely correlated. In a couple of clear examples, biologics moved in the opposite direction of hardware.
2. Medtronic spine has been steadily improving on all three categories since 2012. *(See graph on page 14.)*

And one clear conclusion. Hardware dominates.

Orthopedics' Bias to Innovation

Medtronic's data shows that spine hardware is the main event and biologics, while absolutely necessary and valuable to spine surgery, are still an adjunct in the OR.

As Dr. Hochschuler characterized spine surgeon attitudes toward biologics: "Most docs tend to use the biologic that the metal carrier carries."

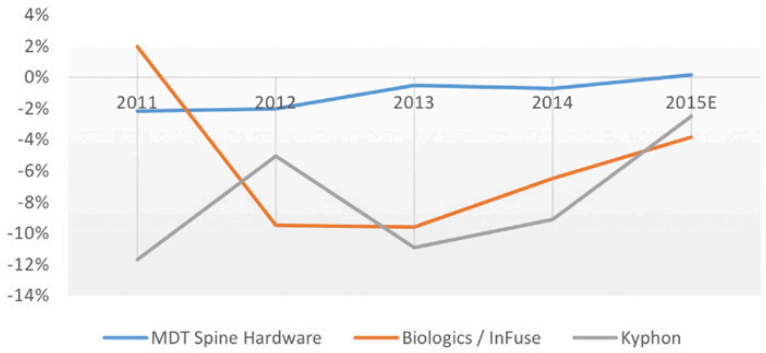
XTANT's Goldberger, as the new kid on the block, had some interesting insights into his new industry home.

Essentially, he told *OTW*, orthopedics has a bias to innovate.

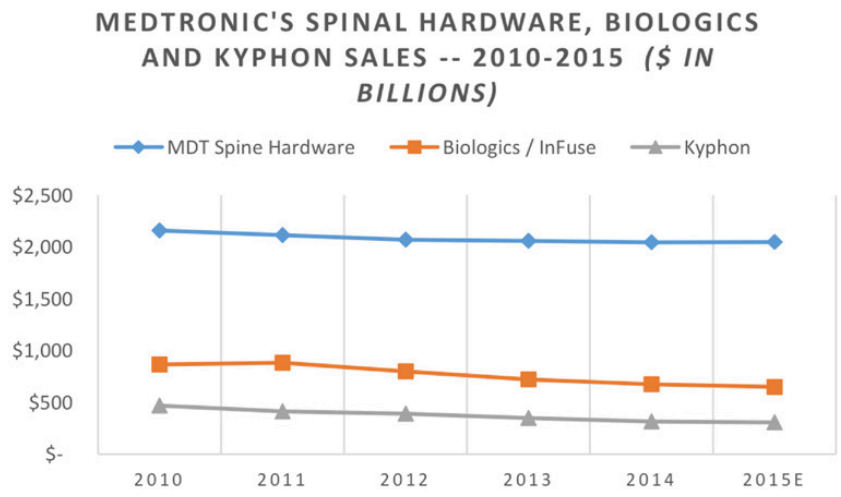
"The barriers to entry in orthopedics are remarkably low and one result of that is that the pace of innovation is accelerated."

"Part of the reason that low barriers exist is the relative lack of data which ortho-

Year-to-year Percent Sales Change: Medtronic Spine



Source: RRY Publications LLC and Public Documents



Source: RRY Publications LLC and Public Documents

pedic physicians require to look at new products. In my previous companies we required significantly more human clinical data. Blockbuster products—really in any sector of medicine—excel because they have data."

And that industry bias to innovation fits Goldberger well—albeit with more data.

Goldberger went on to say that the culture and DNA of XTANT—like the firms he led in the past—is rooted in innovation. "Our catalog of implants and biologic products versus other small spine companies is built on highly proprietary innovations versus 'meat and potato' plates and screws."

The similarities between XTANT and his earlier firm are striking.

"When I went to Sound Surgical Technologies (SST) in 2007, I walked into a turnaround situation which had very similar challenges to those I encountered at Bacterin (now XTANT). Inventory was out of control. Innovation had languished. Distributors were frustrated. We transformed SST and, now, Bacterin, into growth and innovation engines."

"Our innovative OsteoSponge DBM and 3Demin DBM Fibers, Boats and Strips, for example, are wildly successful. With the merger with X-Spine we've now teamed up with David Kirschman. M.D., and I'm optimistic that the two of us (with full tissue processing capabilities) will develop exciting combination (hardware and biologic) products."

And remember, Goldberger holds 60 patents. "Personally, I'm a tinkerer and inventor."

Orthopedics: Unique Distribution Model

His other key observation is that within the broader medical device market, orthopedic distribution is unique. "Distribution in orthopedics is very labor intensive. We've embraced that. So the other way we differentiate is with customer care. Right product. Right time. Easy to work with."

Having said that however, Goldberger made a perhaps surprising comment in this era when some companies experiment with a 'rep-less' model.

"We DO see that physicians have strong preferences with regards to their instruments, implants and the reps who serve them. Spine hardware will absolutely be one of the drivers of our growth. At the margin, we believe surgeons will listen to innovative biologics, but when we talk instruments and implants it is usually a much more productive conversation."

"We are taking our biologics to the X-Spine footprint. Those physicians are committed and passionate about their X-spine instruments and implants. Hardware is driving purchase decision making. One upside surprise to our merger with X-Spine is that the top seven of our ten biologics distributors do not have a hardware line."

Growth

With high profile CEOs like Keith Valentine making the case for a strong biologics and spine hardware combination, with Brian Hutchison putting up his revenue numbers, Wall Street's spotlight is tantalizingly close to this sector of the spine market.

Speaking for XTANT, Goldberger told *OTW* "We will continue to invest in tissue processing, expanding our capabilities and investing in more sophisticated capabilities in placental, live cell and other tissue forms. In five years (we like the Globus or NuVasive template of excellent products and breadth of offerings) we will have a broad catalog of highly innovative biologic, metal and combination products for the spine surgeon."

Stay tuned, for sure. ♦

Spine Surgeons Pleading Guilty in Spinal Cap Investigation

BY WALTER EISNER

California's infamous "Spinal Cap" caper continues to spread its tentacles as spine surgeons and others involved in funneling patients into the scheme are pleading guilty to fraud.

Philip Sobol, M.D./ UCompareHealthCare

Mitchell Cohen, M.D./ ZocDocs

At the end of November, the U.S. Department of Justice announced that two California spine surgeons (Philip Sobol, M.D. and Mitchell Cohen, M.D.), a former hospital administrator (James L. Canedo), a chiropractor (Alan Ivar) and a marketing consultant (Paul Richard Randall) were charged with generating almost $600 million in fraudulent spine surgery billings over an eight-year period.

Two of the defendants have already pleaded guilty and the other three have agreed to plead guilty this month. All five have agreed to cooperate fully in the ongoing investigation which is looking to allegations of illegal kickbacks for patient referrals and fraudulent billings.

Photo creation by RRY Publications, LLC

Ground Zero: Drobot and Pacific Hospital

The government is alleging that thousands of patients were referred to Pacific Hospital in Long Beach and that those referrals generated more than $580 million in fraudulent billings, mostly submitted to California's worker's compensation system and federal agencies. The government is also alleging that a similar scheme involving spine surgeries included doctors who received illegal kickbacks for referrals to a Hawaiian Gardens hospital outside of Los Angeles.

Michael Drobot

In April 2014, Michael Drobot, the former owner of Pacific Hospital, pleaded guilty to participating in the scheme and is also cooperating with the investigation.

Drobot was the owner of Pacific Hospital until late 2013. He admitted to running a 15-year-long scheme in which he and others billed workers' compensation insurers and the U.S. Department of Labor hundreds of millions of dollars for spinal surgeries and other procedures performed on patients who

had been referred by dozens of doctors, chiropractors and others who were paid illegal kickbacks.

Provider Kick-Back Scheme

Now those accused of accepting and offering the kickbacks are being charged and pleading guilty.

The government said that Drobot and his conspirators typically paid kickbacks of $15,000 for each lumbar fusion surgery and $10,000 for each cervical fusion surgery. Some of the patients traveled hundreds of miles to Pacific Hospital despite living closer to other qualified medical facilities. The patients, of course, were not told that their referring docs had been offered and accepted kickbacks to induce them to refer them to Pacific Hospital. From 2005 through 2013 Pacific Hospital billed insurers more than $580 million for spinal surgeries on more than 4,400 patients. Insurers paid the hospital more than $226 million for the surgeries performed as a result of the illegal kickbacks.

Bogus Contracts

The conspirators, according to the government, concealed the kickback payments by entering into bogus contracts to provide a "cover story" for the surgeons, chiropractors and others who received illegal payments.

For example, the government says a number of doctors entered into agreements with a Pacific Specialty Physician Management (PSPM), a company owned by Drobot, under which the doctors received as much as $100,000 per month from Drobot in return for the right to purchase their medical practices—an option that was never exercised. Drobot's company paid some doctors inflated prices for the right to operate their practices and collect on their insurance claims.

In other cases, according to the government, Pacific Hospital entered into contracts with doctors under which the doctors were to help the hospital collect surgery bills from insurance companies, but the hospital's own collection staff, rather than the doctors, actually performed the collections work. Several doctors entered into lease agreements under which Drobot's

management company or his hospital paid rent for the use of office space, but rarely used the space. And other doctors had agreements to provide consulting services to Drobot's companies, but did not actually provide the services. Still others, including marketers who introduced doctors to Pacific Hospital, had additional agreements with Drobot's companies.

Recent Case Unsealed

All of the current cases were unsealed by a federal judge on November 24, 2015. Named in the cases are:

- James L. Canedo of San Pedro, California, is the former CFO of Pacific Hospital in Long Beach, who pleaded guilty on September 4, 2015, to a criminal information charging him with participating in a conspiracy that engaged in mail fraud, honest services fraud, money laundering, paying or receiving kickbacks in connection with a federal health care program and violating the Travel Act, specifically, interstate travel in aid of a racketeering enterprise. He is scheduled to be sentenced on June 17, 2016.
- Philip Sobol, M.D. of Studio City, California, an orthopedic surgeon who has agreed to plead guilty to conspiracy to commit mail fraud, honest services fraud and violations of the Travel Act; as well as a separate, substantive Travel Act violation. He is expected to be arraigned shortly.
- Alan Ivar of Las Vegas, a chiropractor who had lived in San Juan Capistrano, California, and owned several businesses based in Costa Mesa, California, was charged with one count of conspiracy to commit mail fraud, honest services fraud, money laundering and violations of the Travel Act. In a plea agreement also filed in November, Ivar admitted that for well over a decade, he had an agreement with Drobot to refer patients in exchange for a monthly retainer. Ivar, who also agreed to plead guilty, is expected to be arraigned this month.
- Paul Richard Randall of Orange, California, a health care marketer previously affiliated with Pacific Hospital and Tri-City Regional Medical Center in Hawaiian Gardens, pleaded guilty on April 16, 2012, to conspiracy to commit mail fraud. Randall, who admitted recruiting chiropractors and doctors to refer patients to Tri-City in exchange for kickbacks, is scheduled to be sentenced on April 8, 2016.
- Mitchell Cohen, M.D. of Irvine, California, an orthopedic surgeon, was charged in mid-November with filing a false tax return. Cohen admits in a plea agreement that he failed to report income received from kickback payments and is expected to be arraigned this month.

Sobol, Ivar and Cohen each received, respectively, $5.2 million, $1.24 million and $1.64 million in kickbacks. Together they referred more than 200 patients to Pacific Hospital.

Randall has admitted to introducing doctors to Drobot and coordinating kickback arrangements. According to his plea agreement, he acted as a "marketer" for Tri-City and conspired with hospital executives to pay kickbacks to doctors and chiropractors to refer workers' compensation patients Tri-City for spinal surgeries. As in the Pacific Hospital scheme, the surgeries at Tri-City involved use of spinal surgery hardware that Randall distributed to Tri-City at inflated prices through his company Summit Medical Group, knowing that the cost would be passed on to insurers.

Using proceeds from the sale of the hardware, the government says Randall paid a 5% kickback to Tri-City and kickbacks of up to $20,000 per surgery to the doctors and chiropractors who referred the patients. In addition, Randall paid kickbacks to doctors in return for referrals of patients for toxicology tests though a separate company, Platinum Medical. The scheme resulted in several million dollars in losses to insurers.

More Fallout

The tentacles of Spinal Cap reached into the California State Senate where former Senator Ron Calderon was indicted last year on charges that he accepted $100,000 in bribes from Drobot to preserve a loophole in the law that allowed companies he controlled to charge more for hardware used in spinal surgeries.

Calderon is also accused of taking bribes from undercover FBI agents posing as Hollywood movie executives in exchange for steering legislation in their favor. He has pleaded innocent to the charges against him and is awaiting trial next year.

Coast-to-Coast

And then in a really bizarre twist of the investigation, spine surgeons and hospitals around the country are being sued by insurance companies for allegedly accepting illegal payments, largely in consulting fees, in return for their hospitals buying non-FDA approved spinal implants made by Spinal Solu-

tions, LLC, another company related to the Drobot case.

In one case, a well know surgeon at Baltimore Washington Medical Center is accused of taking one of the "sham" consulting deals, causing the hospital to allegedly buy over $1 million in hardware delivered by private aircraft.

"Our review is continuing, but we have found no evidence that the alleged non-FDA approved hardware was ever received or used in spinal surgeries" at the hospital, said a hospital spokesperson. "The hardware identified in the complaint is used in a very specific type of spine surgery; only a small percentage of patients who underwent spinal surgery at [the hospital] during this time period had this specific kind of surgery."

There are 17 hospitals and 15 physicians named in the private insurer lawsuits. The providers are in California, Texas, Wisconsin and Nevada, in addition to Maryland.

More to Come

"Injured workers were treated like livestock by doctors and hospitals who paid or accepted kickbacks and bribes in exchange for referrals," said California Insurance Commissioner Dave Jones. "Injured workers are put at risk when their medical treatment is based on kickbacks and bribes instead of their medical needs. Detectives from the Department of Insurance worked closely with federal law enforcement agencies to investigate and expose this illegal conspiracy, which is one of the largest worker's compensation insurance fraud cases we have ever seen."

The ongoing "Spinal Cap" investigation is being conducted by the FBI, the United States Postal Service Office of the Inspector General, the Internal Revenue Service and the California Department of Insurance. As prosecutors promised, there is still more to come. ♦

Profile: C. Lowry Barnes, M.D.

BY ELIZABETH HOFHEINZ, M.P.H., M.ED.

Many years ago, a young resident paraded behind his mentors, patiently doing rounds and absorbing knowledge. He had no idea that one day, he would sit in *the* chair…that he would *be* the chair. But as of August 2015, C. Lowry Barnes, M.D. is the Chair in Orthopaedic Surgery at the University of Arkansas for Medical Sciences (UAMS).

After graduating with honors from the UAMS College of Medicine in 1986, Dr. Barnes remained at UAMS for his internship and residency in orthopaedic surgery. He then went "up East" where he completed a fellowship in Adult Reconstructive Surgery and Arthritis Surgery at Harvard Medical School and Brigham and Women's Hospital in Boston.

Dr. Barnes went on to found Arkansas Specialty Orthopaedics, where he was president for more than a decade. Regarding his move to academia, Dr. Barnes tells *OTW,* "I made a gradual transition from private practice because it was only right that I give my patients and partners sufficient notice. The most exciting aspect of this move has been helping transform the department into a growth engine. For instance, in September 2014 the adult practice saw 400 new patients in a month; that number has now grown to 1,000 per month. Patients previously waited several months to see someone in some of our orthopedic subspecialties; now, we make sure that all patients are seen within two weeks of their initial phone call."

"The timing was right…and we were very fortunate that the university was willing to allow us to do new things. Rick Smith, M.D., the Dean allowed us to develop a compensation plan that rewards production—not only clinically, but from a research standpoint as well. While that helped to motivate people, it was not enough…we needed new strategies. For example, access to care was difficult for our patients who are in outlying areas (something particularly stressful for those with mobility issues). We established an offsite clinic—a freestanding, one story building that people can drive right up to. I'm pleased to say that I've heard from a number of patients I saw in private practice who are convinced that our clinic now works just as well as or better than my private practice."

Developing a World Class Academic Program in Orthopedics

As for adjusting to how things operate in academia, Dr. Barnes notes, "The reality is that things take longer to get done in a university, largely because more people are required to sign off on projects and because there are *so many* projects. I was accustomed to a private practice with a single specialty orthopedic group where it was easy to make decisions. It was somewhat different in that private practice shareholders have equal votes. Here at the university, we have had a departmental consensus on each project undertaken thus far. These decisions then require approval of others because it's an academic institution with a hierarchal system. Fortunately, our early success has created a certain trust factor with those to whom we report."

"Another adjustment is that the university has adopted service lines for clinical care. Although we have a musculoskel-

C. Lowry Barnes, M.D.

etal service line, many doctors in my department are in other service lines as well. Although you could see that this might cause friction, the chair of neurosurgery and I have worked hard to create a non-competitive atmosphere for our spine surgeons. As of now, we have two trauma surgeons working in the trauma surgery line and two orthopedic tumor surgeons in the cancer service line."

Step One: Transparency and Cross-Pollination

All of this cross-pollination helps give Dr. Barnes the ability to take a detailed look at the daily, yearly, and monthly activity in the department. "Our motto is 'transparency,' something that allows us to look carefully at the number of new patients seen each week, the total seen each week, etc. Everyone in the department sees everyone else's numbers, including who has published that month. Each week we even have a report on length of stay for each surgeon. My faculty members see my work RVUs (Relative Value Units) each week. As long as I am producing significantly no one questions what I am doing…and besides, they are the recipients of my early morning and late night emails. Being so open with this information is going a long way toward our quest for excellence."

Step Two: Build the Talent Pool

"In a very short period of time, we have added a spine surgeon, two other joint surgeons, a foot and ankle surgeon, and two hand surgeons. We have an offer out for another joint surgeon and are also hiring a new Chief of Pediatric Orthopaedics and a staff position in pediatrics. We should be able to treat any kind of orthopaedic injury that occurs in our state. The days of replants, brachial plexus injuries, etc. being transferred elsewhere are over."

Step Three: Research, Research and More Research

"On the research front, we are expanding our focus on biomechanics, and combining our funding and efforts with that of Dr. Stavros Manolagas, M.D., Ph.D. at UAMS. He is a talented metabolic bone researcher who is exploring bone turnover, bone production, the prevalence of osteoporosis, the effect of cancer on bone, and other things related to the basic biology of bone. Also exciting is our new osteomyelitis program that is led by Mark Smeltzer, Ph.D. a microbiologist who is part of our orthopedic bone research center. Then there is our nanotechnology division where we are working on bone scaffolding, regeneration of bone

tissue in large defects, and coatings for implants with Alex Biris, Ph.D. This kind of environment is especially wonderful for residents. They might have a challenge in the OR, go to the lab looking for a better way to do X, talk with the researchers, and then test an idea to see if it works. There are only a few other entities in the U.S. with all of this under one directorship…and the fact that we have the nanotechnology is even more rare."

Asked what best prepared him to lead the department, Dr. Barnes said, "I was a managing partner and led a number of practice mergers in our city. I also served on the Finance Committee and Board of St. Vincent's Infirmary. To be able to bring that background to an academic department is a real boost. And fortunately, I am accustomed to managing a demanding practice while still being a busy clinician and researcher."

Conclusion: Build on Your Clinical Strengths

Asked to imagine how he would react if someone dropped a million dollar grant in his lap, Dr. Barnes said, "I would spend a portion of that money on hiring more people for our lab so that we could support researchers early in their careers when they are preparing for external funding. I would allocate some funds to further resident education, thus allowing them to travel to more meetings and present their research. In addition, I would work more on technological solutions for patient education (such as easy apps that verify that patients truly understand what we are teaching them). We are doing our best on this now, and are working with Kristie Hadden, Ph.D., who is new to our department and specializes in health literacy. Our literature needs to be as clear as possible; we are loading questions into the EPIC software so that when a patient has an intake done we get an idea of his or her health literacy so that we can treat the patient in a more personal manner."

"We are trying to move our department to the place where we have the right surgeon performing the right surgery at the right time. We will eventually have only pediatric orthopedic surgeons taking children's call, only trauma surgeons taking trauma call, etc. It's all part of this exciting growth process that will result in our patients having the best care possible." ♦

COMPANY

Medtronic Spine Sales Flat – Improvement Expected

On December 3, 2015, Medtronic plc's spinal division reported another quarter of flat revenue with sales of $719 million.

Overall, the company reported a 6% rise in sales, while the company's Restorative Therapies Group (RTG) rose 5%. The company's other divisions had analysts swooning over results. The company generated $1.1 billion in free cash flow and expects to generate nearly $40 billion in free cash flow over the next five years.

But spine, which is part of the RTG, declined around 4% on a reported basis. Outside the U.S., spine sales rose 5%.

Spine had strong double-digit growth in Japan, in the Middle East and Africa and solid mid-single digit growth in Canada and Latin America.

BMP had flat international sales in the quarter due to the impact of stop shipment in Europe. Management said the issue is limited to a third-party manufacturing facility that only supplies the European market. While the supplier has identified the remediation plan, management does expect to be off market for the remainder of the fiscal year, reducing expected international BMP revenue by approximately $7 million per quarter.

Medtronic Spine 2Q16	Sales ($ in millions)	% Change*
Total Reported Sales	**$719.0**	**flat**
Core Spinal		down 1%
Biologics		8.00%
Interventional Spine		down 4%

Source: Medtronic plc
** Constant currency*

Courtesy of Medtronic plc

Mike Sheffield of the *Memphis Business Journal* reported that the last few quarters of decreased spine revenue had led analysts to predict an end to the decreases after new products were launched. He wrote that Edward Jones analyst John Boyland said, "One quarter doesn't make a trend, but we're starting to see some positives out of spinal. It's basically because competition is intense, and that will continue. But, we think we're starting to see evidence of things starting to turn."

Needham & Co. analyst Mike Matson said that Medtronic lost share in a slow growth spine market. Spine sales were $7 million short of consensus. He estimates that Medtronic's core spine declined 1%, interventional spine decline 4%, and BMP (Infuse) grew 8%, all on a constant currency basis. According to Matson, on a constant currency basis, the global spine market grew by 1% in the third quarter of 2015, a decrease from 2% in the second quarter. Year-over-year, he estimates that Medtronic lost 0.6% of spine market share.

Improvement Expected

Management told analysts on December 3, 2015, that new product launches, the realigned RTG sales management, and surgical synergy programs are expected to drive improved spine growth.

Specifically, management expects core spine results to improve as numerous recent and upcoming product launches reach scale, including the Elevate Expandable Cage and Solera Voyager System in thoracolumbar as well as the Divergence Stand-Alone Interbody Cage the ZEVO Anterior Cervical Plate System, the Prestige LP Cervical Disc and Anatomic PTC interbody spacer in cervical.

Company Chairman and CEO Omar Ishrak didn't have much to say about the company's spine performance. He did, however, note that the new integrated RTG sales management structure has already finalized several new contracts in a program that combines O-arm placements with increased spine implant commitments. "While still early, our expectation is that strategies like this will result in improved performance." — *WE*

Wireless Spinal Cord Stimulator Cleared by FDA

The FDA has granted clearance to the world's smallest wireless eight-electrode spinal cord stimulator (SCS) system. The agency granted clearance to a four-electrode device last year made by the same company.

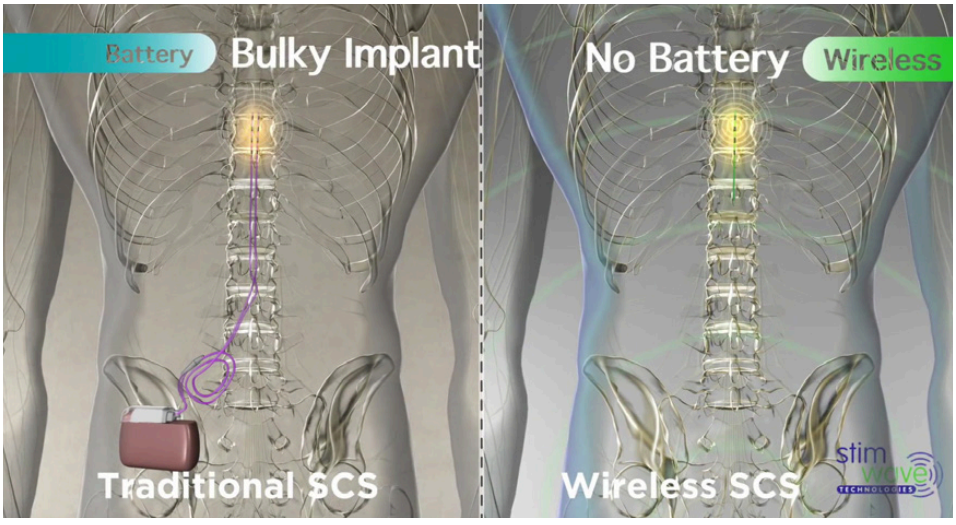
On December 9, 2015, Stimwave Technologies Inc. announced FDA clearance of its Stimwave Freedom-8A SCS system. The company says its system is the world's first wireless, fully programmable SCS neuromodulation device available and "presents a potentially life-changing technological breakthrough" for more than 90 million people in the U.S. with daily chronic back and leg pain.

The company has also begun commercialization of the device and began implanting in the first patients earlier this quarter. Full nationwide commercialization is planned for the first of the year.

Laura Tyler Perryman, the company's chairman and CEO said, "Patients utilizing the Stimwave Freedom-8A and Freedom-4A products not only have the option of a wireless device, but the recent advancements in this technology's platform also provide the majority of the programming and placement features available from wired systems that are 95 percent larger." She added that a current FDA approved clinical trial is looking at the safety and efficacy of even wider programmability options, or high-frequency programming up to 10,000 Hz.

The wireless option eliminates the need for tunneling and placement of internal batteries in the patient's body. Stimwave's stimulator is implanted in an outpatient procedure through a standard needle with no need for general anesthesia or a large surgical incision. The company believes this approach is expected to significantly reduce the lifetime cost of care for chronic pain patients and offer a safe, viable and effective alternative to pain medications.

The technology leverages a tiny, state-of-the-art device that delivers small pulses of energy, in a fully-selectable manner, to eight electrodes placed near surrounding nerves, triggering a reaction that enables the brain, according to the company, to remap specific pain signals, thus providing pain relief. — *WE*



Freedom-8A SCS System/Stimwave Technologies

LEGAL

FDA Gives Up Off-Label Fight With Pacira

The FDA has given up its attempt to limit Pacira Pharmaceuticals Inc.'s promotion of its pain drug, Exparel. The company wanted a supplement to their label that showed the drug was not limited to a specific surgery.

Photo creation by RRY Publications, LLC

The FDA threatened Pacira with a warning in 2014 over the company's promotional materials. The agency said those materials violated the off-label promotion prohibition. Exparel is used on the site of a surgery and is marketed as an alternative to opioid pain pills.

The company sued the agency in September citing the First Amendment and *Amarin* case where a federal court ruled that companies had the constitutional right to speak truthfully about its products.

The agency clearly did not want another loss in a federal court which undermines its diminishing authority to regulate truthful speech.

In a letter to the company on December 14, 2015, the agency waved the white flag and said, "It's important to note that

this resolution is specific to the parties involved in this matter." Janet Woodcock, the agency's director of the Center for Drug Evaluation and Research, wrote that after further review, the agency had concluded that the drug's approval wasn't limited to the two types of surgeries. The language of the label had "created ambiguity."

In *Amarin,* the same court where Pacira filed its suit, ruled the agency couldn't prohibit Amarin Corp. from talking to physicians about unapproved uses of its fish-oil pill. Physicians are allowed to use devices and drugs off-label but companies have been restricted on talking about off-label uses, unless a physician specifically requested the information. The *Amarin* ruling allows companies to hand out the information more widely without a request.

As we reported earlier, the FDA has promised to hold public hearings and find a better way to get more truthful and scientific information to the medical community and the public without prohibiting free speech. This surrender in the Pacira case signals that soon there may be a floodgate of demands by companies and physicians to distribute and receive truthful information not found on a company's original approved label. — *WE*

FDA Approves New Uses for Infuse

Medtronic plc's Infuse bone graft has been granted Supplemental FDA Approval for three additional spine surgery indications.

The company expects to begin marketing the expanded indications in early calendar year 2016. With this expanded approval, the company said on December 11, 2015, that it will be able to market the bone graft for use with certain spine implants made of polyetheretherketone (PEEK) in oblique lateral interbody fusion (OLIF) and anterior lumbar interbody fusion (ALIF) procedures.

New Indications

The indications for use are:

- Use in OLIF51 Procedures with certain sizes of the PEEK Perimeter Implant at a single level from L5-S1.
- Use in OLIF25 Procedures with certain sizes of the PEEK Clydesdale Implant at a single level from L2-L5.
- Use in ALIF procedures with certain sizes of the PEEK Perimeter Implant at a single level from L2-S1.

Peter Whang, M.D., FACS, an associate professor in the Department of Orthopaedics at the Yale School of Medicine in New Haven, Connecticut, said, "For my anterior and anterolateral lumbar spine fusion cases, the use of Infuse Bone Graft allows me to reliably obtain a solid arthrodesis without having to harvest bone from the patient's own hip which generally requires a second incision, results in significant pain, and increases the risk of complications such as bleeding or infection." He added that he believes that "the proven osteoinductive properties of Infuse Bone Graft are particularly beneficial when used in conjunction with PEEK interbody spacers and the less invasive OLIF technique, which circumvents the psoas muscle and minimizes disruption of the surrounding soft tissues and neural structures."

Infuse

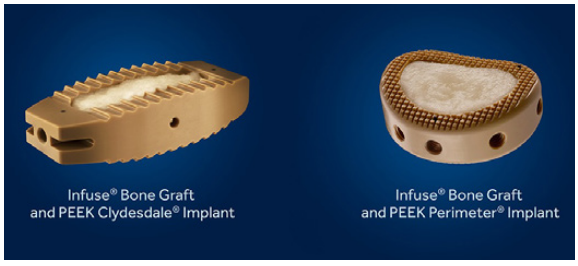
Infuse is used with certain Medtronic interbody fusion devices to treat lumbar degenerative disc disease. The company says the active ingredient in Infuse—rhBMP-2—is a manufactured version of a protein already present in the body that promotes new bone growth. During surgery, it is applied to an absorbable collagen sponge (ACS). The ACS is a carrier to deliver the rhBMP-2 to the implant site and acts as a scaffold for the formation of new bone, and it will resorb, or disappear, over time.

OLIF Procedure

According to the company, the OLIF25 procedure helps surgeons preserve the patient's psoas muscle when treating the L2-L5 levels of the spine. Additionally, the procedure gives surgeons "easier access around the patient's iliac crest - enabling placement of an implant into the disc space for anterior column support." The OLIF51 Procedure provides lateral access to the L5-S1 disc space and doesn't require surgeons to flip the patient from an anterior position during surgery.

The graft is not indicated for use with a trans-psoas surgical approach.

Infuse has been one of the most controversial products used off label in the spine. The company has been sued, maligned and accused of paying off surgeons to misrepresent clinical results. None of the accusations have stood up to independent scrutiny. With supplemental approval of these expanded indications, the company continues to build on the incremental progress of demonstrating the safety and effectiveness of the product. — *WE*

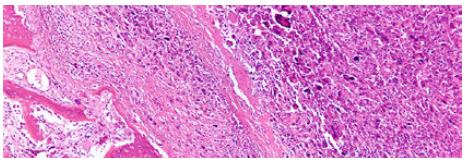


Infuse Bone Graft/Medtronic plc

BIOLOGICS

Antibody Treatment Could Reduce Amputations in OS Patients

Osteosarcoma (OS), a rare cancer that primarily affects adolescents and children, originates in the bone tissue. Researchers from the University of Copenhagen have discovered that OS



Wikimedia Commons and Nephron

cells degrade the bone tissue through a completely different process than metastasized bone cancer.

Led by Dr. Niels Behrendt and Dr. Lars Engelholm, a team at the Finsen Laboratory, Rigshospitalet and BRIC has been able to use an antibody to block this process. In doing so, they reduced up to 80% of bone degradation in a mouse model. The hope is that using this antibody will lead to a reduction in amputations.

"A large proportion of new targeted cancer therapies are based on antibodies. We developed this antibody for basic studies of the molecule uPARAP, but when [sic] we discovered shown that this molecule is upregulated in OS tumours, we became interested in the possible treatment effect," said Dr. Behrendt in the December 2, 2015 news release.

Dr. Behrendt told *OTW*, "Research through the last few years has revealed that the receptor uPARAP/Endo180 is engaged in bone remodeling during normal bone growth. Cancer cells often 'abuse' the same molecules and cellular mechanisms as those working in the healthy tissue from which they are derived. This led to the idea that osteosarcoma (cancer cells derived from osteoblasts in the bone) might utilize the same receptor in bone degradation. We then showed that the receptor is indeed expressed on osteosarcomas (unlike most other cancer cells) and studies in a mouse model showed that we could counteract tumor-mediated bone degradation with an antibody against uPARAP/Endo180."

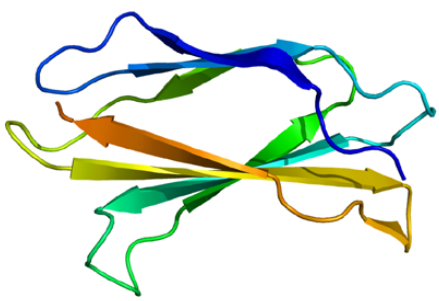
"It may soon be possible to counteract osteosarcoma-mediated bone destruction in osteosarcoma patients by novel means of treatment. This should complement existing strategies (treatment with bisphosphonates, etc.) which are not sufficiently efficient. This is particular important as a strategy for neoadjuvant treatment where tumor destructive activity needs to be controlled during a period of chemotherapy prior to surgery." — *EH*

LARGE JOINTS

RA Marker Informs You 16 Years Before Disease Arises

Talk about advanced warning! Scientists from the Kennedy Institute of Rheumatology at Oxford University have found a marker that can tell you whether you might eventually have rheumatoid arthritis (RA)…and it can tell you this information even 16 years before the condition takes effect! Specifically, the team found that a blood test that looks for antibodies that recognize the protein tenascin-C could reliably predict who will get RA.

As indicated in the December 10, 2015 news release, "When inflammation occurs in the body, some proteins are altered in a process called citrullination. These altered forms can prompt an immune response from the body, which can see it turning antibodies on itself—causing rheumatoid arthritis. For that reason, tests that spot antibodies to citrullinated proteins are already used to diagnose the disease. While tests for individual proteins usually have a relatively low diagnostic sensitivity, a more general test called CCP, that detects synthetic citrullinated peptides, identifies a lot more RA cases."



Wikimedia Commons and Emw

Lead researcher Dr. Anja Schwenzer said, "We knew that tenascin-C is found at high levels in the joints of people with RA. We decided to see if it could be citrullinated and, if so, whether it was a target for the autoantibodies that attack the body in RA. That might also indicate whether it could be used in tests to indicate the disease."

"When we looked at results from more than 2,000 patients we found that testing for antibodies that target citrullinated tenascin-C (cTNC) could diagnose RA in around 50% of cases, including some cases not identified by CCP. It also has a very low rate of false positives—it is 98% accurate at ruling out RA."

Dr. Schwenzer told *OTW*, "In a large number of rheumatoid arthritis patients, autoantibodies bind to proteins that harbour a specific modification termed citrullination. In order to improve diagnosis and treatment of rheumatoid arthritis it is important to identify the proteins that are attacked by these antibodies. We knew that the protein tenascin-C, which is usually absent in healthy tissue, can be found at high levels in the inflamed joints of people with rheumatoid arthritis. We decided to see if it could be citrullinated and, if so, whether it was a target for the autoantibodies that attack the body in rheumatoid arthritis. That might also indicate whether it could be used in tests to indicate the disease."

"We found that antibodies against citrullinated tenascin-C are associated with an increased disease activity in rheumatoid arthritis. It is also known that these kind of antibodies correlate with poor prognosis and progressive joint destruction, and that these patients often require more aggressive treatment." — *EH*

Shaky Connection Between Radiographic Evidence and Pain

Wikimedia Commons and Planningviz

Pain in the hip means a patient has osteoarthritis. Right? Researchers from Boston University School of Medicine say "Not so fast." According to Caitlyn Fitzpatrick, writing for *MD Magazine*, in the Farmington Study of 946 patients ages 49 to 79 only 15.6% of patients with frequent hip pain had radiographic signs of osteoarthritis. And only 20.7% of patients with radiographic signs of osteoarthritis had frequent hip pain.

"Given these findings, patients with suspected hip osteoarthritis should be treated regardless of X-ray confirmation," said Chan Kim, M.D., corresponding author of the study. He added, "The majority of older subjects with high suspicion for clinical hip osteoarthritis did not have radiographic hip osteoarthritis, suggesting that many older persons with hip osteoarthritis might be missed if diagnosticians relied on hip radiographs to determine if hip pain was due to osteoarthritis."

The study revealed that hip pain and osteoarthritis do not match up in many cases. Kim noted that failing to catch an osteoarthritis case has harmful consequences. The condition has already been linked to sleep disturbances and heart problems when it requires total joint replacement surgery. And the clinical implication, according to Fitzpatrick, is that test results should not determine whether or not to move forward with a possible hip osteoarthritis diagnosis. — *BY*

Docs Provide Free Implants in Kentucky

Three orthopedic surgeons at the Christ Hospital Health Network spent their Saturday, December 5, providing free hip and knee replacements to low income patients who did not have health insurance. According to the *Northern Kentucky Tribune*, their work was sponsored by Operation Walk USA. The surgeons were Patrick Kirk M.D., Edward V. A. Lim, M.D. and Michael Swank, M.D. The surgeries were performed at the Christ Hospital Joint & Spine Center.

Operation Walk USA was originally founded as a mission trip for orthopedic surgeons to provide joint replacements in underdeveloped countries. Operation Walk USA is an independent organization that arranges donations from vendors to cover the cost of knee and hip replacement surgery along with post-operative care for low-income patients who lack insurance and can not afford the surgery on their own.

Operation Walk USA works with joint implant vendors, including DePuy Synthes Companies and Zimmer Biomet, who donate the implants for these procedures. The Christ Hospital donates all other charges and expenses associated with the surgeries.

In addition to the orthopedic surgeons, anesthesiologist, radiologists, hospitalists, pathologists, cardiologists, and staff from across the Christ Hospital Health Network volunteered their time on Saturday, Sunday, and Monday December 5, 6 and 7, to assist with the surgery and post-operative care of the three recipients.

"I am truly grateful for the opportunity to participate in the Operation Walk program," Kirk told the *Tribune* reporter. "Thanks to the overwhelming support of the many volunteers at Christ Hospital, these patients will be treated, their mobility will be restored, and their lives will be changed for the better." — *BY*

OUR HEROES

(Left to right: Patrick Kirk MD, Michael Swank MD and Edward Lim MD) / Courtesy of Christ Hospital Health Network

10% Weight Loss = 56% Less Cartilage Degeneration

A recent retrospective study has shown that the loss of 10% of body weight by obese patients slows the degeneration of their knee cartilage. As reported by Kristina Fiore, staff writer for *MedPage Today,* those who lost the most weight had the greatest reduction in the rate of cartilage damage.

Fiore quoted Alexander Gersing, M.D. of the University of California, San Francisco, who said, "Substantial weight loss not only slows knee joint degeneration, it also reduces the risk of developing osteoarthritis. The studies show there is a protective aspect of weight loss on knee cartilage. Weight loss may slow or prevent osteoarthritis."

The study enrolled 506 patients with a mean age of 62 and a body mass index of 30.2 kg/m. Sixty percent of the patients were women. Over the four years of the study 177 patients lost between 5% and 10% of their body weight. Seventy-six patients lost more than 10%; 253 patients, who did not lose any weight, served as the controls.

Researchers found that those who lost the most weight had less cartilage damage. The patients who did not lose weight had a 0.9-point increase in T2 measurements over four years. Those who lost 5% to 10% of their body weight had about the same increase. But, according to Gersing, the patients who lost at least 10% of their body weight had an increase of less than 0.4 points ion their T2 score which meant a 55.6% reduction in the rate of cartilage layer damage.

"Degenerative joint disease is a major cause of pain and disability in our population and obesity is a significant risk factor," Gersing warned "Once cartilage is lost in osteoarthritis, the disease cannot be reversed."

Fiore quoted Salomao Faintuch, M.D., of Beth Israel Deaconess Medical Center in Boston, who was not involved in the study:"Even though we like prospective studies better to provide scientific evidence, the retrospective design is not really a problem in this study.It is obvious and well known that losing weight helps people in so many different ways. The real novelty of this study is showing that how much weight you lose really makes a difference. Losing a little bit can make things better, losing even more makes it even better than that. It is important to be able to quantify that, if you lose weight, your joints are going to do better." — *BY*

Wikimedia Commons and Frei Sein

EXTREMITIES

Pin-Less Bone Lengthening Device Invented

Amr Abdelgawad, M.D., an orthopedic surgeon at Texas Tech University Health Sciences Center, El Paso, Texas, has invented a novel implantation device that can lengthen the bones of young people internally and with significantly less trauma and morbidity. "Current limb-lengthening techniques are uncomfortable and can make kids feel socially awkward," explained Abdelgawad.

Inventor: Dr. Amr Abdelgawad / Courtesy of Texas Tech University Health Sciences Center, El Paso, Texas

The standard bone-lengthening process involves cutting the bone in half and then placing a bulky, tubular frame around it for six to nine months. The frame, known as an external fixator, is joined to the broken bone through large pins that penetrate the skin. The fixator slowly pulls the two halves of bone apart, which promotes new bone tissue to grow in between them.

According to Abdelgawad, his invention sidesteps the bulky frame, and avoids penetrating the skin with pins, which can lead to infection. No pins also means there will be less pain and scarring.

He also notes that his device will be the first of its kind that can be used on children who still have growth plates. Growth plates are structures that are vital for bone growth of the young. They eventually disappear. Current internal bone-lengthening techniques cannot be used on children, he says, because they would damage the growth plate.

Abdelgawad's device, he claims, could completely avoid potential damage of the growth plate. It is entirely internal, requiring a single implantation of a thin, metal plate that attaches alongside the bone with screws. Using a handheld remote control, the patient can adjust the rod to extend slowly over time, extending the bone. "This is going to give children who need it access to bone-lengthening," said. Abdelgawad. "It's going to help those who suffer from skeletal deformities like dysplasia, limb-length discrepancies or those who have suffered from bone trauma."

The device is reported to still be in the development phase and is co-patented with Noe Vargas Hernandez, Ph.D., an associate professor of engineering at Carnegie Mellon University. — *BY*

SPINE

New Screw-Less, Rod-Less Spine Fusion Device From Australia

Scientists and spine surgeons from the University of New South Wales (UNSW) in Australia have invented a new spinal fusion device that stabilizes the spine, reduces chronic back pain and promotes fusion without screws or rods.

Called the Thru-Fuze device, its inventors hope that it can someday replace more invasive and expensive methods of treating degenerative disc disease (DDD) surgically. The current standard of surgical intervention for DDD requires a system of screws, rods or cage systems as well as drilling into the spine and a bone graft harvest.

Professor Bill Walsh, one of the inventors of Thru-Fuze and Director of Surgical and Orthopaedic Laboratories at the University of New South Wales, said that the device will allow faster, simpler surgery with minimal radiation exposure compared to current methods.

"Existing methods of spinal fusion use rod or cage systems that require screws to be drilled into the spine and a painful bone graft harvested, which is the material used to form the bridge and obtain the fusion between the vertebrae in the spine," he said. "These systems are very costly, difficult and time consuming to implant and they also have variable rates of fusion success. Existing methods rely on the bone to make its way right across the vertebrae and it can take up to a year to find out if the surgery has been a success."

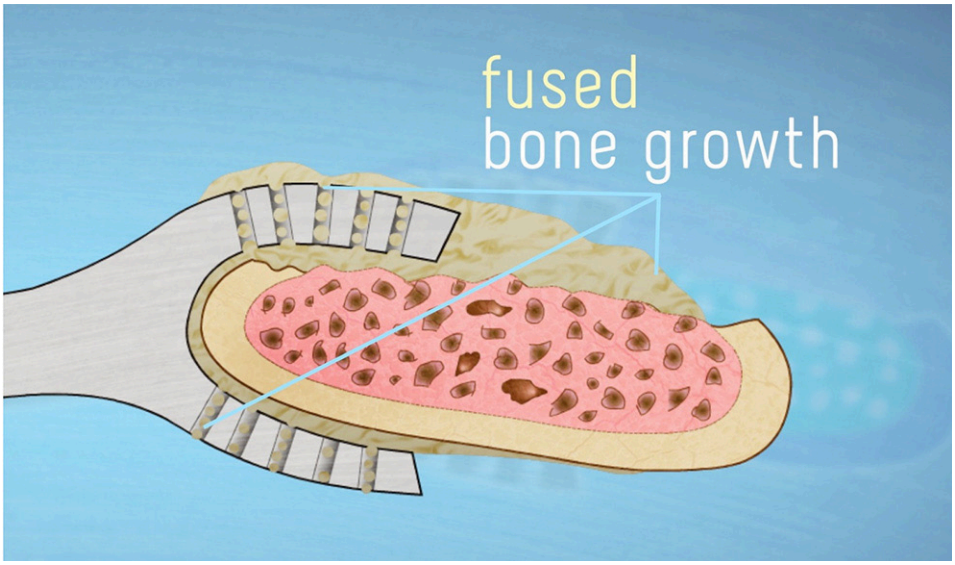
The Thru-Fuze device is innovative because it stabilizes the spine without the need for a bone graft.

UNSW surgeons hope that the Thru-Fuze device, following human clinical studies and regulatory approvals, will transform spinal fusion surgery for the treatment of degenerative disc disease.

Walsh's team has shown that bone will fuse on and through their invention when it is placed between vertebrae, resulting in rapid 'biomechanical' fixation. "Over time, the device then acts as a bridge between the adjacent vertebrae for additional bone to grow across, fusing the adjacent vertebrae together, bone to bone," Walsh said.

Human trials are expected to begin at the Prince of Wales Hospital, Sydney in late 2016. They have been made possible through $1.59 million in funding from the NSW Government's Medical Device Fund. Patents for the technology have been filed in Australia, Europe, China and the United States.

Here is a video which illustrates the very novel device: Click here to watch. — *BY*



Courtesy of University of New South Wales, Australia

SPORTS MEDICINE

Activity, Not Rest, New Concussion Treatment

Wikimedia Commons, Internet Archive of Book Images and RRY Publications, LLC

Researchers at the University at Buffalo are studying how a program of low level exercise—instead of total rest—may be a more effective treatment for concussions.

They predict that the standard of care for acute concussion may undergo a dramatic change, depending on the results of a new exercise treatment that physicians at the Jacobs School of Medicine and Biomedical Sciences at the University at Buffalo (UBMD) have developed and begun testing. Their test will be the first randomized, controlled clinical trial of this exercise treatment for concussion.

A press release by Ellen Goldbaum, University of Buffalo's news content manager, urged adolescents from western New York who have had a concussion to contact UBMD Ortho as soon as possible after the injury. Doctors hope to see them within a day or two of the injury if possible. The University of Manitoba is also participating in the study, so the new treatment is available to adolescents living near Winnipeg, Canada. The trial will continue until the summer of 2016.

"If you're an adolescent who has experienced a concussion in the last few days either on the field or off, we want to see you ASAP," said John Leddy, M.D. who is the principal investigator on the study. Leddy is medical director of the UB Concussion Management Clinic, a physician with UBMD Ortho, and clinical professor in the Department of Orthopaedics in the Jacobs School of Medicine and Biomedical Sciences at UB. He sys that interested parents should contact the UB Concussion Management Clinic at 716-829-5499. — *BY*

What? Ultra Long Distance Runners Regenerate Cartilage…!

What happens to the cartilage of ultra long distance runners during a race? It appears, according to a study conducted during the 2009 Trans Europe Foot Race and presented at the November 30, 2015 Radiology (RSNA) conference in Chicago, that cartilage regenerates itself during the race.

Using a mobile MRI truck a team of researchers accompanied 44 ultra-athletes on a 4,500 kilometer race known as the Trans Europe Foot Race (TEFR) which took place from April 19 to June 21, 2009.

The ultra-endurance race started in southern Italy and ended in the North Cape in Norway. Forty-four of the runners (66%) agreed to participate in the study which lasted for nearly10 weeks. After following and measuring the runners over the 64 day race, the research team was astonished to find that cartilage in the knees of these athletes had partly regenerated despite the severe stresses (or because of them?) of running literally thousands of kilometers in a single race.

According to Uwe Schütz, M.D. radiologist and specialist in orthopedics and trauma surgery, Department of Diagnostic and Interventional Radiology University Hospital of Ulm, Germany, and lead investigator, it appears that the joint cartilage is initially altered by this running burden and shows signals of cartilage matrix degradation after the first 1,000 to 1,500 km of running.

But then something changes. When further running occurs the cartilage shows the ability to partially regenerate itself despite the stress on the joints of running.

Schütz wrote that, "This is a new and astonishing finding, first time measured and observed in human joints in vivo." But knowledge of Scandinavian animal studies has shown the same behavior in dog cartilage, he said.

Schütz said that, as a result of this study, there seems to be no distance limit for running in the healthy cartilage. "If you have healthy joints in the legs," he said, "no obesity, leg deformities or other injuries in the lower extremities, you just have to begin the running sport step by step, give yourself enough time to rise to the distance, and there might be no limit regarding the risk of developing joint degeneration."

Co-authors on the study are Christian Billich, M.D., Jutta Ellermann, M.D., Ph.D., Martin Ehrhardt, M.D., Daniel Schoss, M.D., Martin Brix, M.D., Siegfried Trattnig, M.D., Ph.D., Sabine Goed, M.D., Antje Reiner, M.D., and Meinrad J. Beer, M.D., Ph.D. — *BY*

Courtesy of TransEurope Footrace 2009

Orthopedics This Week | RRY Publications LLC

Robin R. Young, CFA
Editor and Publisher
robin@ryortho.com

WRITERS

Elizabeth Hofheinz, M.P.H., M.Ed.
Senior Writer
elizabeth@ryortho.com

Walter Eisner
Senior Writer
walter@ryortho.com

Biloine W. Young
Senior Writer
bgwy@msn.com

ADVERTISING

Tom Bishow
Vice President of Sales
tom@ryortho.com

PRODUCTION

Suzanne Kirchner
Production Manager
suzanne@ryortho.com

Jayme Johnson
Email, Web, & Conference Coordinator
jayme@ryortho.com

Dana Bader
Graphic Designer
dana@ryortho.com

---

116 Ivywood Lane • Wayne, PA 19087
TOLL FREE: 1-888-749-2153
www.ryortho.com