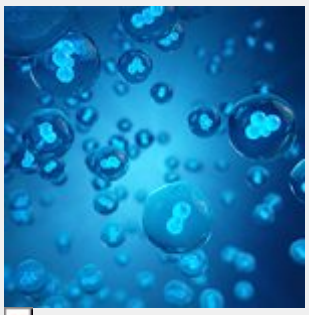
Stem Cells: Panacea or snake oil?



They are billed as the new keys to longevity, an endless inventory of “spare parts” that can regenerate sick or tired organs, a veritable Fountain of Youth.

But are stem cells the medical cure-all of the future, or are they just a snake-oil pitch to the desperate and vulnerable?

An article entitled “Stem Cells Are Mostly Theory, Yet Clinics Are Flourishing” by Gina Kolata of the *New York Times* summarizes the conundrum. While Regenerative Medicine research is proceeding frenetically on a variety of disease fronts, with occasional promising results, a “free-fire” zone has emerged in which stem cells are touted as a cure-all.

Stem cell therapies are being offered for everything from knee pain to lupus, paralysis, insulin-dependent diabetes, Alzheimer’s and Parkinson’s Disease, and even ALS. Anti-aging and cosmetic applications include “stem cell facelifts,” “stem cell breast augmentation,” as well as sexual enhancement procedures (penile enlargement and “vaginal rejuvenation”).

Conceptually, it might make sense. Stem cells, at least in theory, are “pleuripotent” i.e. they are undifferentiated cells that have the potential to grow into whatever replacement parts the body requires. The notion of taking a shot of stem cells, harvested from belly fat or bone marrow, to replenish cartilage, heart muscle, or even brain cells, is intuitively appealing. The idea is that they’ll travel to whatever parts of the body need fixing and grow there.

While, for example, only experienced neurosurgeons can inject stem cells directly into the brain (as they are now doing experimentally in an attempt to reverse Parkinson’s Disease), any doctor with a syringe and an office centrifuge can draw out some stem cells, spin them down, and then shoot them back in via an arm vein or directly into a sore knee.

But therein lies the rub: Will a concentrate of stem cells, in the absence of special preparation or priming, “take” when injected into the bloodstream or a joint? Researchers are struggling with the problem of coaxing pleuripotent stem cells to properly differentiate into the specialized cells that make up the organs they are intended to repair or replace.

An influential paper, “Selling Stem Cells in the USA: Assessing the Direct-to-Consumer Industry” deplores the recent proliferation of private stem cell clinics Stateside. It used to be that desperate patients desirous of unproven stem cell therapies had to travel to far-flung off-shore locales like China, Mexico, India or the Caribbean to obtain treatments. The authors say that such practices, now readily available in the U.S. “are exposing their clients to non-compliant stem cell interventions” and that these “prompt ethical concerns about the safety and efficacy

of marketed interventions, accuracy in advertising, the quality of informed consent, and the exposure of vulnerable individuals to unjustified risks."

Putting aside the question of whether stem cells work (which we'll tackle momentarily), what could possibly go wrong? For patients with conditions that aren't amenable to usual medical or surgical fixes, "you pays your money and you takes your chances"—right? What's the problem with offering choices if patients are willing to use their discretionary dollars to cover the steep 5-digit fees, almost invariably not covered by insurance?

An article in the *New England Journal of Medicine* entitled "Glioproliferative Lesion of the Spinal Cord as a Complication of 'Stem Cell Tourism'" highlights the risks. A 66-year-old man traveled to China, Argentina, and Mexico to obtain stem cell injections in his spine to overcome residual paralysis after a stroke. He then developed back pain, lost whatever ability he had left to walk, and was unable to control his bladder. An MRI revealed a large tumor of a heretofore unseen mixed cell type in his spinal cord.

Another patient who had stem cells injected into his kidneys as a treatment for lupus developed an unusual renal tumor; In Russia, still another developed a brain tumor after injections of neurally-derived stem cells into his cerebellum. While these may represent instances of poorly-regulated administration of stem cells not conforming to strict safety protocols, they still underscore the risk of introducing cells with the potential to multiply unpredictably.

Additionally, it is of some concern that the reason that cancer chemotherapy often fails in the end is because tumor cell lines eventually revert to undifferentiated cancer stem cells (CSCs) which are notoriously resistant to therapy. Would indiscriminate injection of stem cells cause this? This remains a matter of some controversy.

Infection and autoimmune reactions have also been described as the side effects of stem cell therapies.

Do stem cell therapies work? Clearly, yes, in some instances they have shown great promise. But the proven applications of stem cell therapy are few and far between.

One study showed that stem cells derived from abdominal fat, when applied to hard-to-treat anal fistulas in patients with Crohn's disease, upped the rate of healing (34% to 50%).

And a mouse study suggests that stem cells could help reverse the damage of strokes. But the stem cells in question were of a special type—neurally-derived and specially prepared with a unique protein that potentiated their differentiation into functioning neurons.

Specially-prepared stem cells have shown promise in repairing damaged hearts in rodents, but researchers state that "many questions remain to be answered before clinical applications [in humans] can be made."

Keep in mind that the "Holy Grail" of stem cell research for decades has been the regeneration of specialized cells within the pancreas called "Islets of Langerhans" which would offer a cure for insulin-dependent diabetes. While steady progress has been made toward this elusive goal, researchers suspect that testing in humans may still be several years off. And they need to make sure that tumor development is not a consequence of stimulating the stem cells to grow.

When it comes to repairing knees as an alternative to total knee replacement, the word isn't out on stem cells, despite widespread marketing and availability of direct injection of stem cells for knee problems. But knee procedures are notorious for generating a hefty placebo effect. For example many patients report "relief" from arthroscopic surgery for knee arthritis, but clinical trials show that it is no better than placebo "sham surgery" for producing lasting improvements.

A review of stem cells for knee osteoarthritis concluded that, with so many differing protocols being offered, it's currently hard to perform the right kind of clinical trials to incontrovertibly demonstrate that they work. Improved techniques may eventually yield more definitive results, but "in conclusion, stem cell therapy may not become a standard treatment for knee OA till the end of the decade."

In my opinion, would-be early-adopters of stem cell therapies would be wise to "keep their powder dry" until techniques are perfected. There's no question that Regenerative Medicine will play a major role in the future; thousands of researchers are laboring tirelessly to come up with better ways of coaxing stem cells to reliably do what we want them to do, without untoward side effects. It's worth the wait.

Listen to my *Clinical Focus* podcast on Stem Cells here: Part One, Part Two.