Carcinogenic Threat of Elastin-Rich Surgical Devices – A Review

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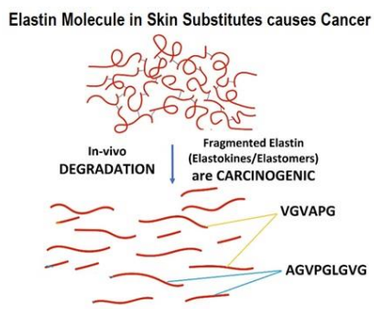
Abstract:
The purpose of this article is to review a series of recent publications[1,2] on the pathological correlation between carcinogenicity of the bio-degraded elastin components and the cancer risks of elastin-containing tissue regenerative biological devices. Recently, an abundant number of intact tissue-derived devices are launched in the market without the realization of the carcinogenic threat of the Elastin molecule. Even FDA seems to be unaware of these scientific facts to take appropriate safety measures or at least to take efforts to consult with reputed biological scientists to explore the possible threats of using such allografts and xenografts which are listed here with the approximate % elastin content in parentheses.

ALLOGRAFTS	XENOGRAFTS
Human Amniotic membrane (42%)[3]	Porcine Skin (10%)[6]
Human Amniotic powder (42%)[3]	Porcine Intestinal Wall (10 %)[7]
Human Placenta (49%)[4]	Porcine Urinary Bladder (9%)[8]
Human Umbilical Cord (25%)[5]	Equine Pericardial Membrane (42%)[9]
Human Skin (10%)[6]	Porcine/Fish Skin (10%)[6]

This opens up a very serious patient safety issue when using any of the above products that are derived from intact-tissue membranes containing elastin for tissue regenerative purposes. If the awareness of such scientific facts explodes, it might lead to class-action lawsuits down the road as it happened to silicone breast implant cases. As an example, in the past, the FDA allowed silicone breast implants due to the suspicion of its possible carcinogenicity, which got banned in 1992. Eventually, in 1994, a class-action lawsuit was settled by the Manufacturer with a payment of $4.25 billion[10].

Methods:
Adequate literature surveys and analyses were adopted as the methodology in this review article. As a Biomaterial Scientist, the main focus of this publication is to reveal the biological safety of elastin-containing biomaterials. Accordingly, our literature search focused on varied scientific publications about the biodegraded fragments of elastin known as elastokines. We have discussed the carcinogenic impact of such molecules to have the regulatory authorities converge on this topic.

Discussion & Conclusion:
It is very important to understand the main related article that got published quite recently in Nature journal[1] only by the end of 2020. Please see below the diagrammatic representation of the facts expressed in this review article.



In support of the same fact, there is one more relevant scientific publication[2] that declares even the autologous elastin when degraded would result in cancer. The article describes the cigarette smokers have an elevated expression of Cathepsin-S (a cysteine protease) that degrades elastin in the lungs which is also reported to cause cancer.

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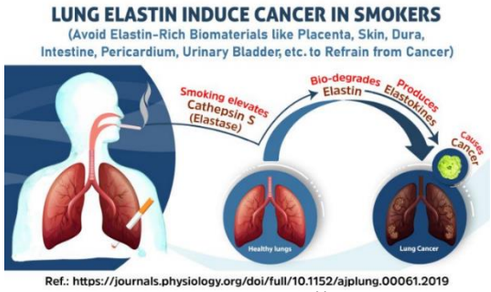
Elastin exists in 13 isomeric forms with varying chain



lengths of 151 to 714 amino acids[11] which is specific for each individual.

Accordingly, elastin from one person could pose an impaired biocompatibility threat to the host tissue of another individual. However, this incompatibility is of minimal magnitude compared to the latest major scientific documentation in the Nature journal[1] which asserts the fact that Elastin's biodegraded molecules (elastokines/elastomers) are potential carcinogens. More literature evidence[12] was found for Elastin fragments to cause various pathological conditions including emphysema, chronic obstructive pulmonary disease, atherosclerosis, metabolic syndrome, etc. While we analyzed the literature further, it is obvious that every organ prone to cancer is rich in Elastin. Examples include colo-rectum[13], oral[14], breast[15], lungs[16], blood[17], etc.

Our concluding remark based on growing scientific evidence is to avoid any medical-surgical usage of elastin-rich biomaterials which could potentially cause cancer. As an alternate, more emphasis is being given for non-immunogenic, native, biocompatible, Type-I collagen-based tissue regenerative surgical products for clinical usage**.**

References:
1. Winkler, J. et. al (2020). Concepts of extracellular matrix remodeling in tumor progression and metastasis. Nature communi, 11(1), 1-19.
2.https://journals.physiology.org/doi/full/10.1152/ajplung.00061.2019
3. https://pubmed.ncbi.nlm.nih.gov/16968153/
4. www.liebertpub.com/doi/10.1089/ten.tea.2011.0738
5. https://pubmed.ncbi.nlm.nih.gov/9852359/
6. www.ncbi.nlm.nih.gov/pmc/articles/PMC6940999/
7. https://link.springer.com/article/10.1007/s10029-020-02238-y
8.www.scielo.br/j/ibju/a/pp3bVw7XTtcLdVVMzGNFJGK/?lang=en
9. www.ncbi.nlm.nih.gov/pmc/articles/PMC7175169/
10. https://www.latimes.com/archives/la-xpm-1994-09-02-mn-33883-story.html
11. www.uniprot.org/uniprot/P15502
12.www.tandfonline.com/doi/full/10.1080/10409238.2020.1768208
13. Li, J. et. al (2020). Elastin is a key factor of tumor development in colorectal cancer. BMC cancer, 20(1), 1-
14. www.mdpi.com/2218-273X/11/1/39
15. Salesse, S., et. al (2018). Elastin molecular aging promotes MDA-MB-231 breast cancer cell invasiveness. FEBS open bio, 8(9), 1395-1404.
16. Yusa, T., et. al (1989). Tumor Cell Interactions with Elastin: Implications for Pulmonary Metastasis1• 2. Am Rev Respir Dis, 140, 1458-1462.
17. https://pubmed.ncbi.nlm.nih.gov/18971876/

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