

Exosomes: cancer research review



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Exosomes (The research behind cancer biomarkers)

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Introduction

Exosomes are small vesicles which are found in many body fluids, such as blood and urine (1, 2). Its diameter is between 30 and 100nm, but much smaller than a bacterial cell. Exosomes can be released from the plasma membrane or by multi vesicular bodies fusing with the plasma membrane (3). Specialized functions of exosomes play a role in sending signals for intercellular membrane and changing behavior on the next cell (1).

Exosomes can be used for medication, diagnosis, and targeting for disease and health. Exosomes were also observed in reticulocyte as maturing mammalian (immature red blood cell), (4) when the maturing mammalian reticulocyte turns to be a mature red blood cell (erythrocyte), a large number of plasma membrane were removed by the exosomes (5). Endosomes are part of the plasma membrane as small vesicles and due to its shape is called multivesicular bodies. These smaller vesicles called intraluminal endosomal vesicles found in the larger body. The intraluminal endosomal vesicles (ILV) are formed as exosomes when the multivesicular bodies fuse with the plasma membrane releasing these tiny vesicles into the extracellular space (6).

Exosomes' work and mechanism

Exosomes play a captivating role arranging adaptive immune responses for the pathogens and tumors; over the membrane vesicle trafficking, exosomes transferring molecules, impacting the invulnerable process including dendritic

cells and B cells (7). This is why it has been suggested that mRNA in exosomes can prevent producing proteins in the beneficiary cell (8). Different study of miRNAs of exosomes which are secreted by the (MSC) mesenchymal stem cells that mainly are not grown miRNAs (9). Exosomes production and content are mainly affected by the molecular signals and machinery received by the cells of origin. Evidence suggested that by releasing exosomes of the tumor cells adapt to hypoxic microenvironment to facilitate metastasis or to stimulate angiogenesis for more preferred environment (10).

The research of exosomes

Exosomes contain the transferrin receptor from red blood cells that is not present in mature erythrocytes. Exosomes delicate MHC I, MHC II, and other stimulatory molecules by its derived dendritic cell have proven to promote specific T cell that are responded in vivo. Other than that in early clinical traits, exosome having cancer pollination schemes are being discussed (11). It's released by kidneys into urine, and their discovery would play an impressive tool (12, 13, 14). Exosomes in urine can be beneficial as treating targets in prostate glands (15, 16). Tumor cells secrete some exosomes to transfer signals to the surrounding cells and assort myofibroblast differentiation (17). There is a diagnostic possibility when exosomes are released from neoplasms into the blood. Patient blood samples that inconsistent exosomal are stored as targeting analysis when colorectal cancer cell of exosomes are pinned into the blood stream that may be healed at several temperature after 90 days of storage (19).

Bioinformatics analysis of exosomes

Exosomes contains proteins, RNA, lipids and metabolites that are meditative according of the original type of cell. As it has a high concentration of these molecules, a huge scale analysis such as proteomics and transcriptomics is often performed. In order to anatomize these data presently, non-commercial tools such as FunRich (20) may be used to distinguish over-represented groups of molecules

Exosomes in cancer

Exosomes contains proteins and nucleic acids where different types of cells release them. Exosomes associated with breast cancer contain microRNAs (miRNAs) which is also linked with the RISC-Loading Complex (RLC) and show how cell-independent capacity process precursor small RNAs pre miRNAs into grown miRNAs. Exosomes of cancer cells contains Pre-miRNAs together with Dicer, AGO2, and TRBP. CD43 arrange the accumulation of Dicer specially in cancer exosomes (21). For reprogramming the target cell transcriptome, cancer exosomes intermediates efficient and rapid silencing mRNAs. Patients with breast cancer initiate nontumorigenic epithelial cells that is forming tumors in a Dicer-dependent manner is happening because of exosomes derived from cells and sera of the patients. Due to these finding exosomes based biomarkers and therapies propose a huge opportunities for its development (21).

Functions and Therapeutic Roles of Exosomes in Cancer

Exosomes are small vesicles released by different cells and are secreted from cancer cells by a large number (22-25). These small vesicles are used to separate tissues where they initiate behavioral changes (22-25).

Exosomes being malignant or normal cells, are now becoming familiar to be important in chemotherapeutic resistance, tumorigenesis and apoptosis. Attenuation or modulation of tumor immune responses together with metastatic niche generates its participant of tumorigenesis primarily from two processes; alteration and restricting of the cellular microenvironment (24). Exosomes stimulate the changes of microenvironmental tissues that simplify the structure of the tumor. In the other hand, exosomes are disarming anti-tumor immune responses at the same time, giving the chance for cancer cells to immigrate. Exosomes prevent invincible exposure, interconnects to other locating targets from the patient, and produce metastatic growth (26, 29). The considerable clinical potential has resulted in a fundamental body of work that is discovering signals in exosome derived by tumors; the investigation that leads in enhancing the result of the patients (26, 29).

Conclusion

Exosomes give information about the cell's content whether it's a normal cell, hitting toward being malignant or fully malignant. Exosomes potentially therapeutics to directly target cancer cells and kill them without killing the healthy cells. It can also carry cancer from patient's immune cells and inject them back to the patients with the hope to boost their immune responses against their own cancer. By lowering these small vesicles of exosomes with

very specific targeted molecules that can only damage the cancer cell not the normal cells.

References

1. Van der Pol E, AN, Harrison P, Sturk A of extracellular vesicles, 2012; 676-705.
2. Keller S, Sanderson MP, 2006; 102-8.
3. Booth AM, Fang Y, *J. Cell*, 2006; 932-935.
4. Johnstone RM, Adam M, Hammond JR, 1987, *Chem* 262.
5. Van Niel G, Porto-Carreiro I, 2006; 13-21.
6. Gruenberg J, van der Goot GF, 2006; 495-504.
7. Li XB, Zhang ZR, Schluesener HJ, " Role of exosomes in immune regulation". 2006; 364-75.
8. Balaj, L.; Lessard, " Tumour microvesicles contain retro transposon elements and amplified oncogene sequences", 2011.
9. Chen, TS; Lai, RC; Lee, MM;" Mesenchymal stem cell secretes enriched in pre-microRNAs" , 2010 .
10. Park, J, Tan, H. S: Datta, Protein excretion and exosomes", 2010; 1084-99.
11. Mignot G, Roux S, 2005; 376-88.
12. Pisitkun, T; Shen, RF; Knepper, MA, 2004; 10: 13368-73.
13. " Urinary Exosome Protein Database", 2009.
14. Nilsson, J; Skog, J, AProstate cancer-derived urine exosomes, 2009.
15. Fat capsules carry markers", 2009.
16. Mitchell PJ, 2009.

17. Webber J, Steadman R, Mason M. D, 2010; 9621–30.
18. Kobayashi M, Jan, 2014.
19. Kalra, H; Mathivanan, S, Comparative proteomics evaluation of plasma exosome, 2013.
20. FunRich Functional Enrichment Analysis, 2014.
21. Taylor FF, Volume 26, Issue 5, p707–721, 10 November 2014
22. Gercel-Taylor C. MicroRNA, 2008; 110(10): 13–2110.
23. Rabinowits G, Exosomal microRNA, 2009; 10(1): 42–610.
24. Tavoosidana G, Ronquist G, et al. Multiple recognition assay reveals prostasomes as promising plasma biomarkers for prostate cancer, 2011; 108(21): 8809–1410.
25. Thery C, Zitvogel L, Amigorena S. Exosomes: composition, biogenesis and function. Nat Rev Immunol, 2002; 2(8): 569/7910.
26. Psaila B, Lyden D, 2009; 9(4): 285–9310.
27. Sceneay J, Smyth MJ, Moller A. The pre-metastatic niche: finding common ground, Cancer Metastasis Rev 2013, 32(3–4): 449–6410.
28. Zhang H-G, Grizzle WE. Exosomes and cancer, 2011; 17(5): 959–6410.
29. Whiteside TL. Immune modulation of T-cell, 2013; 41(1): 245–5110.