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Calcium concentration of parathyroid patients receiving doses of technetium

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Abstract:

In the mechanistic study, we examined the effect of the diagnostic dose of radioactive tinnitium-99 on the calcium concentration in the patient's blood .Technetium-99 is one of the industrial isotopes that does not occur freely in nature. Its half-life is (6 hours). Technetium-99 can be obtained from the reaction of molybdenum-99 with a proton (Mo-98 (p, g) TC-99). One of the side effects of the harmful substances that human poison is exposed to is fragile cells, including the thyroid gland, the parathyroid gland, and the pituitary gland. These glands are responsible for calcium levels in the blood. It has been shown that the effect of an increase or decrease in the hormone T4 thyroxine, which is responsible for the thyroid gland, leads to a decrease in calcium in the blood. Either high or low TSH, which is responsible for the pituitary gland, has no effect on the level of calcium in the blood .As for the T3 hormone, which is responsible for the parathyroid gland, there was no increase or decrease, so the percentage was normal for the same age group.

Key word: radioactive , Technetium, molybdenum, thyroid gland, parathyroid gland, blood,

تركيز الكالسيوم
لدى مرضى الغدة الدرقية الذين يتلقون جرعات من التكنيشيوم

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مستخلص:

في الدراسة الحالية قمنا بدراسة تأثير الجرعة التشخيصية من التكنيشيوم-99 المشع على تركيز الكالسيوم في دم المريض. التكنيشيوم-99 هو أحد النظائر الصناعية التي لا تتواجد بشكل حر في الطبيعة. عمر النصف له (6 ساعات). يمكن الحصول على التكنيشيوم-99 من تفاعل الموليبدينوم-99 مع بروتون (Mo-98 (p,g) TC-99). ومن الآثار الجانبية للمواد الضارة التي يتعرض لها جسم الإنسانوبالتحديد الخلايا الهشة ، بما في ذلك الغدة الدرقية، والغدة الجار درقية، والغدة النخامية. هذه الغدد مسؤولة عن مستويات الكالسيوم في الدم. وقد تبين أن تأثير زيادة أو نقصان هرمون الثيروكسين T4 والمسؤولة عنه الغدة الدرقية يؤدي إلى انخفاض نسبة الكالسيوم في الدم. أما ارتفاع أو انخفاض هرمون TSH، المسؤولة عنه الغدة النخامية، فلا يؤثر على مستوى الكالسيوم في الدم. أما بالنسبة لهرمون T3 المسؤولة عنه الغدة الجاردرقية فلم يحدث أي زيادة أو نقصان، فكانت النسبة طبيعية لنفس الفئة العمرية.

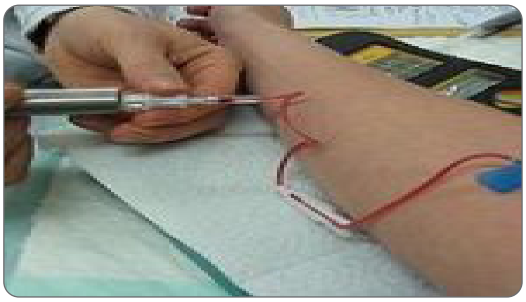
الكلمات المفتاحية : النظائر المشعة ، التكنيتيوم ، الموليبدينوم ، الغدة الدرقية ، الغدة االنخامية ، الدم.

1. Introduction:

Nuclear medicine utilizes specific radioactive materials (radioisotopes) to diagnose and treat a diverse range of illnesses. It is a non-invasive and highly secure procedure for patients, involving minimal radiation exposure, thereby eliminating concerns or apprehensions about the examination. The term "nuclear" is derived from the fact that the radiation utilized originates from the atomic nucleus [1]. The fundamental concept behind nuclear medicine involves administering a radioactive substance to the patient, which is absorbed by a specific organ within the human body. Subsequently, the patient is imaged using a specialized camera that detects the emitted radiation from the organ, providing insights into the internal bodily processes[2] . The quantity of radioactive substance administered varies based on the type of examination and the patient's age. Common nuclear medicine examinations include evaluations of the bones, kidneys, thyroid gland, heart, lungs, brain, lymphatic system, among others[3].

Nuclear medicine provides insights into diseases and the human body that may not be accessible through other methods or imaging devices. Its distinction from conventional radiology lies in its ability to illustrate the functionality of bodily organs rather than solely focusing on their structure, which is common in other imaging techniques. Take the kidney, for instance. CT scans and ultrasound can capture the kidney's structure, dimensions, and detect alterations indicating potential diseases. In contrast, nuclear medicine reveals the kidney's functionality, efficiency, and related aspects[4]. Another significant divergence between nuclear medicine and conventional methods pertains to the radiation source. In typical medical imaging devices like x-ray machines, the patient is exposed to external radiation. However, in nuclear medicine, the patient becomes the radiation source following the administration of radioactive materials [5]. Typically, radioactive materials are administered to the patient via intravenous injection, but there exist alternative methods for introducing these materials. For instance, they can be ingested orally through a capsule or liquid, or inhaled when the material is in a gaseous state[6][7].

Radioactive iodine syrup



Injecting the patient with radioactive technetium intravenously

Radioactive iodine capsules

2- Radioisotope generator:

The generator of radioactive isotopes consists of two sides, one in which the saline solution is placed and the other is placed in which its vicious tube vacuum from the air, which makes a difference in pressure between the two parties [8]. As for the interior, it consists of a column with a molybdenum MO-99 and it is milking (this process is called savings) by passing saline solution that washes this column and picks the TC-99m pertechnetate [9]. With the pressure difference, the technetium is heading to the vicious tube of the air. There is also a filter to prevent molybdenum from reaching the vicious tube of the air. molybdenum is not injected into the patient for the length of the half -life and the damage that may be caused to the patient[10].

3- Tc-99m is made by a radioisotope's generator:

The generation of radioactive technetium by radioisotope generator is the most widely used method in nuclear medicine. In this method, an isotope with a long half-life is generally decayed into an isotope with a short half-life that can be used in nuclear medicine[11][12]. This transformation or reaction takes place in a generator.

In it, radioactive technetium Tc-99m, which has a half-life equal to six hours, is extracted from molybdenum Mo-99, with a half-life of approximately three days (2.75 days). Here molybdenum is called the parent isotope, and technetium is called the daughter [13][14]15].

4- Results:

When people who suffer from diseases of the musculoskeletal system, specifically the skull and cervical vertebrae, are exposed to radiation, the fragile cells, that is, the glands surrounding the head or neck, including the thyroid gland, the parathyroid gland, and the pituitary gland, which is responsible for the body's glands, will be exposed to disturbances in the secretion of hormones.

After taking a group of samples from people exposed to radiation, specifically technetium-99 isotope, for diagnosis, and after two months had passed, it was found that there was a clear effect on the work of the glands in terms of secretion of the hormone T3 and TSH.

The time period for the samples was chosen two months after taking the technetium-99 dose to measure the level of calcium in the blood. This is because all cells are in a state of turmoil for at least six months after exposure to any radiation.

In Table (1), it is shown that the people who took the diagnostic dose of technetium and whose overall age ranges between (50-85) year show that there is a clear change in the secretion of the hormones T4 and TSH that has a direct effect on the calcium percentage, as the increase and decrease in the value of T4 leads to Low calcium concentration. The effect of the TSH hormone is only when the hormone decreases, but if it increases, it has no effect on the percentage of calcium concentration in the blood. As for the effect of the dose on T3, there is no effect within the age range (50-85), as shown in Table (1).

In Table (2) it was shown that the increase and decrease in thyroid and parathyroid hormones do not affect the levels of calcium in the blood for the age range ranging from (23-47), The effect of radiation on the levels of TSH, a hormone specific to the pituitary gland, where there is an increase and decrease in the secretion of the hormone.

5- Conclusion:

An increase in calcium is associated with disorders that occur in the thyroid gland. These symptoms occur if the secretion of parathyroid hormone is high .There is no effect of radiation on blood calcium levels for the age range ranging from (23-47).

Table(1): Shows the relationship of the patient's age between (50-85) to T3, T4, TSH, and blood calcium levels

No.	Gende R	Age (Year)	T_3 1.2-3.1	T_4 66-181	TSH 0.2-4.2	Ca 8.6-10
1.	P1	85	2.94	11.81	0.03	9.0
2.	P2	73	1.4	8.6	0.24	7.9
3.	P3	70	1.34	99.15	2.55	8.52
4.	P4	67	1.34	99.05	2.54	8.51
5.	P5	67	1.9	10.5	8.1	9.9
6	P6	66	1.62	177.5	2.48	3.56
7	P7	60	1.6	7.3	0.08	9.4
8	P8	56	1.72	193.0	0.271	3.08
9	P9	50	1.6	105.46	0.833	9.07

Table(2): Shows the relationship of the patient's age between (47-23) to T3, T4, TSH, and blood calcium levels

No.	Gende R	Age (Year)	T_3 1.2-3.1	T_4 66-181	TSH 0.2-4.2	Ca 8.6-10
10	P10	47	1.1	5.7	6.9	9.7
11	P11	46	3.17	105.46	6.41	8.14
12	P12	45	1.45	96.0	1.57	9.40
13	P13	44	1.8	84.4	2.86	8.13
14	P14	42	1.47	6.9	14.1	10.1
15	P15	41	3.9	14.6	0.05	9.3
16	P16	37	1.98	58.68	35.44	9.49
17	P17	36	1.65	8.7	4.83	9.1
18	P18	35	1.7	8.5	5.3	9.2
19	P19	35	1.29	5.6	15.2	9.0
20	P20	35	1.99	58.67	35.45	9.47
21	P21	35	1.97	58.69	35.46	9.50
22	P22	32	1.84	9.7	6.3	8.9
23	P23	31	2.77	202.1	0.970	9.82
24	P24	28	1.4	7.6	8.3	10.2
25	P25	28	1.60	123.0	0.937	8.81
26	P26	28	2.12	80.76	69.74	9.54
27	P27	27	0.17	1.2	>100	8.5
28	P28	25	2.32	119	1.95	8.73
29	P29	24	2.3	121	1.9	8.7
30	P30	23	1.72	101.98	1.32	8.61

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