Journal of Regenerative Biology and Medicine

ISSN: 2582-385X
Slater G, et al., 2023- J Regn Bio Med
Review Article

Acromegaly: The Impacts of HGH Release on Patient Progression

Gordon Slater[1*], Tandose Sambo[2] and Tayla Slater[3]

[1]MBBS FRACS FA OrthoA, Clinical Private Practice, Double Bay NSW Sydney, Australia

[2]Clinical Private Practice, Double Bay NSW Sydney, Australia

[3]BEng (Hon)/MBiomedEng, Clinical Private Practice, Double Bay NSW Sydney, Australia

[*]**Corresponding Author:** Slater G, MBBS FRACS FA OrthoA, Clinical Private Practice, Double Bay NSW Sydney, Australia.

Received Date: 12-09-2022

Accepted Date: 12-26-2022

Published Date: 01-30-2023

Abstract

Hypersecretion of human Growth Hormone (hGH) is the primary mechanism driving Acromegaly, a disease characterised by abnormal growth of extremities and disfigured facial features. This article will discuss hGH secretion, its effect on Acromegaly, and potential treatments for the disease, among other key topics.

Keywords: Acromegaly; Human growth hormone; Repair; Regeneration; Pituitary.

Introduction

Acromegaly is a rare, chronic medical condition that is impacted by the hyperactivity of the pituitary gland. Acromegaly results in hypersecretion of the pituitary's human Growth Hormone (hGH). hGH is also known as somatotropin. The presence of somatotroph adenomas on the pituitary gland are the predominant cause of acromegaly. As other bodily functions are impacted by concentration of growth hormone, there is also an increase in the detection of insulin-like growth-factor-1.

The impacts of hGH on multiple functions in the body, has made the study of its secretion and regulation a critical area of study in endocrinology. While the primary function of the hGH is in the regulation of the body's metabolic function, there are interactions with the Insulin-like Growth Factor-1 that impact other bodily functions. The hGH is also instrumental in the protein synthesis process, which is critical to growth and body repair.

Acromegaly predominantly affects patients in the age group 40-50. Interestingly, this medical condition is one that affects both males and females equally. As acromegaly continues to remain a medical challenge, the medical research community aims to

Citation: Slater G, Sambo T, Slater T. Acromegaly: The Impacts of HGH Release on Patient Progression. J Regen Biol Med.2023;5(1)1-6.
DOI: https://doi.org/10.37191/Mapsci-2582-385X-5(1)-123

understand its underlying mechanisms better.

The aim of this article is to hone in on the impacts of hGH on the severity of acromegaly that is detected in patients. A thorough understanding of hGH secretion in normal healthy adults, will be discussed, and the deviations in acromegaly cases will be clearly outlined [1-10].

Amount of hGH released: analysis of the hGH secretions of a healthy adult

The pituitary gland is responsible for hormone release in the body. Pulses of hGH are released across the day, according to various factors such as age, gender, diet, pubertal status and activity level.

Via medical statistical analysis [2], the general normal range for hGH secretions are outlined below.

- **For adults assigned male at birth**
  0.4 to 10 nanograms per milliliter (ng/mL), or 18 to 44 picomoles per liter (pmol/L).
- **For adults assigned female at birth**
  1 to 14 ng/mL, or 44 to 616 pmol/L
- **For children**
  10 to 50 ng/mL, or 440 to 2200 pmol/L

Normal value ranges may vary from lab to lab. Be sure to reference the lab's normal range on the lab report when analysing the results. If there are any questions about the results, talk to the healthcare provider.

Growth hormone levels in adults with acromegaly

Acromegaly generally occurs when the hGH secretions exceed the normal range per gender category. Studies have however indicated that in some rare instances, some patients with acromegaly may have normal concentrations of hGH secretion, but the pattern of release is different from that of normal healthy patients. Concentration of hGH and time of release are therefore critical parameters to track when diagnosing acromegaly.

HGH impact on acromegaly progression

The hGH is secreted in a pulse-like pattern across the life spans. Within the pituitary gland, the number of somatotrophs that produce hGH are constant. As the individuals get mature, the secretion pattern of hGH changes. Initial secretions of hGH are naturally designed to promote growth from childhood through adulthood, and latter secretions are for general health maintenance and bodily repair.

HGH secretion matches the circadian rhythms, and the majority of release takes place during the latter stages of the sleep cycle. Sleep therefore plays a critical factor in the body's ability to repair and restore itself. According to medical studies, men secrete the bulk of their daily hGH during sleep, while women secrete only a fraction of their daily hGH during this time.

Age, gender and pubertal status also play a critical role in hGH secretion. Figure-1, highlights the impacts of age on both male and females. In young females, the secretion of hGH is significantly greater than in young males. Overall, hGH secretion is found to be predominantly influenced by estrogen, and not directly with testosterone. The peak output of hGH in women, is found to occur during puberty, at approximately 15-16 years old [3].

Citation: Slater G, Sambo T, Slater T. Acromegaly: The Impacts of HGH Release on Patient Progression. J Regen Biol Med.2023;5(1)1-6.
DOI: https://doi.org/10.37191/Mapsci-2582-385X-5(1)-123

Age and lifestyle

Age and lifestyle play a role in the generation of hGH in the body [1]. As age and lifestyle changes, the presence of body fat in the body may accumulate. Increases in free fatty acids in the body have been linked to insulin resistance in the body. With high insulin levels, the IGF-1 binding protein is suppressed, and IGF-1 levels are increased. hGH levels are impacted significantly by the presence of IGF-1. Decreasing body fat will result in increased levels of hGH output.

Within the body there are various feedback loops. The release of hypothalamic hormones in an episodic manner, influences the release and secretion of hGH. There are two primary signalling hormones that release or inhibit hGH output. Release of hGH is influenced by Growth Hormone Releasing Hormone (GHRH), while the inhibition of hGH is influenced by Somatostatin (SST). IGF-1 also contributes to the inhibition of hGH.

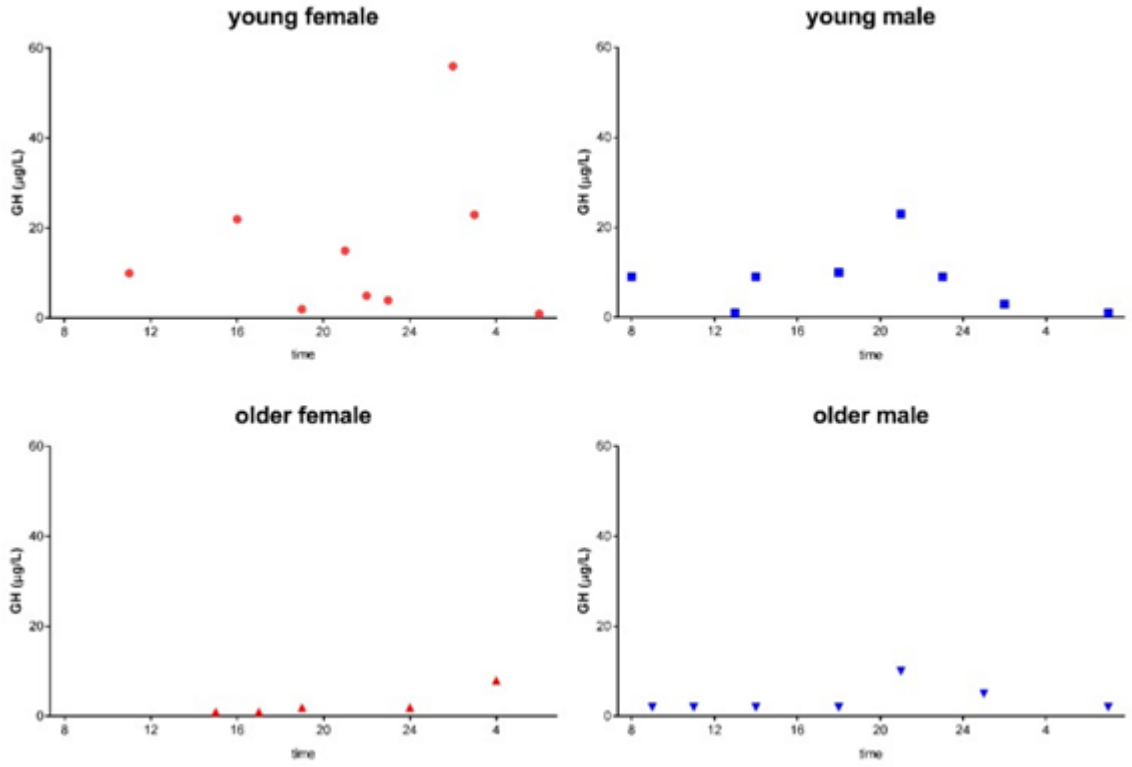

Figure 1: HGH release across age and gender [1].

Cell receptor fatigue

HGH has many receptor sites in the body. Receptors have been found in the sites such as the heart, liver, fat and even the brain. The interaction of these receptor sites with hGH is influenced by the activation of Janus kinase (JAK)-2. (JAK)-2 bonds to two hGH molecules that have integrated into a dimer molecule. The interaction of these two molecules, results in a downstream sequence of molecular interactions that impact critical

Citation: Slater G, Sambo T, Slater T. Acromegaly: The Impacts of HGH Release on Patient Progression. J Regen Biol Med.2023;5(1)1-6.
DOI: https://doi.org/10.37191/Mapsci-2582-385X-5(1)-123

functions such as protein synthesis in the body [1].

Hypersecretion of the hGH is impacted by an adenoma on the pituitary gland, and ultimately leads to acromegaly. As growth processes in the body are accelerated, patients often end up with a disproportionate skeletal frame, and general organ and tissue growth. Enhanced mortality due to the changes in cardiovascular system, pulmonary system and cerebrovascular systems have been noted. The impact of the somatostatin receptor ligands is found to inhibit the release of hGH into the body. As the mechanism of hGH impact is inhibited, normal bodily functions are restored.

HGH is more effectively treated with continuous treatment via a somatostatin analog

There are various treatments of acromegaly. One method involves the infusion of a somatostatin analog called octreotide, into the body via subcutaneous injection [3]. Via a clinical study, both continuous and intermittent infusions of the analog were administered. The impacts of the procedure on critical factors such as hGH secretion, IGF-1 presence, reduction in pituitary adenoma and normal bodily function were assessed. The general result was a normalization in hGH and IGF-1 levels, and a reduction in the pituitary adenoma. When Continuous and Intermittent infusions of the analog were compared, more patients indicated that continuous methods were more effective. 76% of patients were found to have responded favourably to treatment. The patients also exhibited less adverse effects. Medical studies to further understand the underlying mechanisms currently exist.

Effect of pituitary adenoma

The presence of a pituitary adenoma is often what causes the downstream impact of excessive hGH production. From the previous discussion, there is often the existence of body dysmorphia as the hormonal balance is affected. The extremities (hands and feet) grow larger and facial features change; widening of the nose, thicker lips and more prominent cheekbones are indicators of acromegaly. The enlargement of the skeletal structure, face and soft tissues often leads to comorbidities such as hypertension, diabetes and other cardiovascular complications Figure 2 and 3 [9-21].

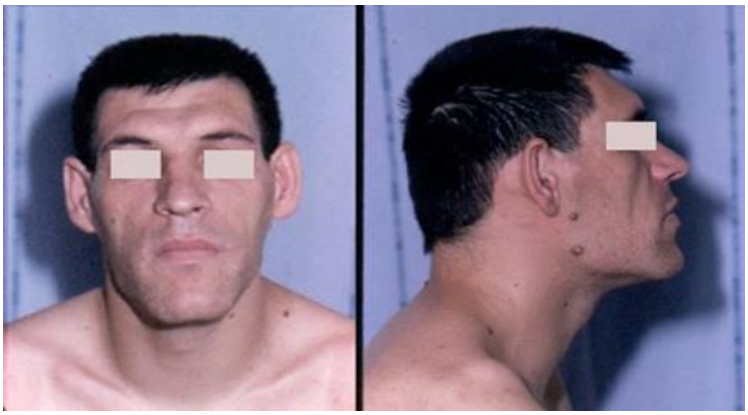

Figure 2: Facial features of a patient with Acromegaly [21].

Citation: Slater G, Sambo T, Slater T. Acromegaly: The Impacts of HGH Release on Patient Progression. J Regen Biol Med.2023;5(1)1-6.
DOI: https://doi.org/10.37191/Mapsci-2582-385X-5(1)-123

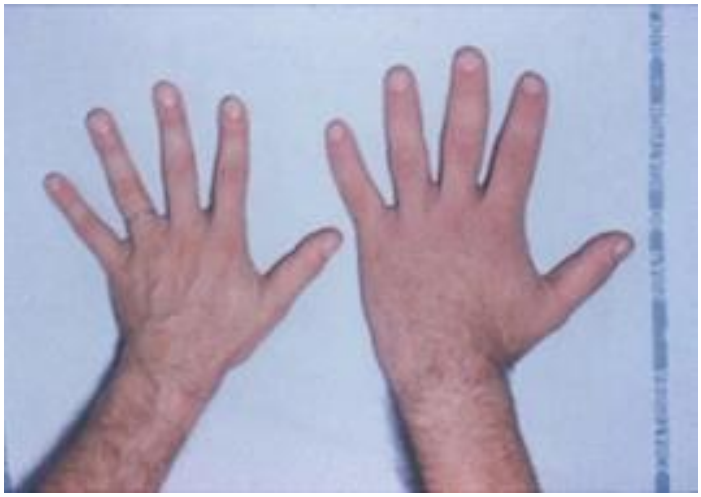

Figure 3: The hand of a normal person(left)compared with an acromegaly patient's hand(right) [21].

HGH abuse

The hGH is a naturally occurring substance in our body. As an enabler for our development, the hGH provides the body with key signals for critical bodily functions. For patients with growth deficiency, or with conditions such as acromegaly, hGH is often administered as treatment. Chemotherapy patients are also treated with hGH.

If excessive hGH is utilized, the abuse of hGH can occur. With a high intake of hGH, the onset of acromegaly can be induced. Additional complications such as the formation of diabetes can also occur. In the athletic realm, hGH is utilized for improving athletic performance. The hope for athletes is that hGH will increase muscle mass. Classified as controlled drugs, prescription access is required for the attainment of hGH.

Conclusion

Acromegaly is a treatable medical condition. With the advent of various forms of medical technology, an appropriate treatment path for the condition can be identified. While non-surgical methods may often be the preferred path, a combination of various therapies can often be applied in order to achieve the outcome wanted.

Disclaimer

Dr Gordon Slater is a medical director of Integrant Pty Ltd, a biotechnology and surgical equipment company. He also has a pecuniary interest in RegenU, Australia.

References

1. Olarescu NC, Gunawardane K, Hansen TK, Møller N, Jørgensen JO. Normal Physiology of Growth Hormone in Adults. Endotext. 2019. PubMed
2. Human Growth Horman (hGH): What It Is, Benefits and Side Effects. Cleveland Clinic. 2022.
3. Harris AG, Kokoris SP, Ezzat S. Continuous Versus Intermittent Subcutaneous Infusion of Octreotide in the Treatment of Acromegaly. J Clin Pharm. 1995;35(1):59-71. PubMed | CrossRef
4. Dineen R, Stewart PM, Sherlock M. Acromegaly. QJM-Int J Med. 2017;110(7):411-20. PubMed | CrossRef

Citation: Slater G, Sambo T, Slater T. Acromegaly: The Impacts of HGH Release on Patient Progression. J Regen Biol Med.2023;5(1)1-6.
DOI: https://doi.org/10.37191/Mapsci-2582-385X-5(1)-123

5. De Herder WW. The History of Acromegaly. Neuroendocrinology. 2016;103(1):7-17. PubMed | CrossRef
6. Mestrón A, Webb SM, Astorga R, Benito P, Catalá M, Gaztambide S, et al. Epidemiology, Clinical Characteristics, Outcome, Morbidity and Mortality in Acromegaly Based on the Spanish Acromegaly Registry(Registro Espanol de Acromegalia, REA). Eur J Endocrinol. 2004;151(4):439-46. PubMed | CrossRef
7. Cannavò S, Ferraù F, Ragonese M, Curtò L, Torre ML, Magistri M, et al. Increased Prevalence of Acromegaly in a Highly Polluted Area. Eur J Endocrinol. 2010;163(4):509-13. PubMed | CrossRef
8. Hernández-Ramírez LC, Gabrovska P, Dénes J, Stals K, Trivellin G, Tilley D, et al. Landscape of Familial Isolated and Young-onset Pituitary Adenomas: Prospective Diagnosis in AIP Mutation Carriers. J Clin Endocrinol Metab. 2015;100(9):E1242-54. PubMed | CrossRef
9. Akirov A, Asa SL, Amer L, Shimon I, Ezzat S. The Clinicopathological Spectrum of Acromegaly. J Clin Med. 2019;8(11):1962. PubMed | CrossRef
10. Hamurcu Z, Cakir I, Donmez-Altuntas H, Bitgen N, Karaca Z, Elbuken G, et al. Micronucleus Evaluation in Mitogen-Stimulated Lymphocytes of Patients with Acromegaly. J Metabol. 2011;60(11):1620-6. PubMed | CrossRef
11. Holdaway IM, Rajasoorya C. Epidemiology of Acromegaly. Pituitary. 1999;2:29-41. PubMed | CrossRef
12. Bondanelli M, Ambrosio MR, degli Uberti EC. Pathogenesis and Prevalence of Hypertension in Acromegaly. Pituitary. 2001;4:239-49. PubMed | CrossRef
13. Colao A, Ferone D, Marzullo P, Lombardi G. Systemic Complications of Acromegaly: Epidemiology, Pathogenesis, and Management. Endocr Rev. 2004;25(1):102-52. PubMed | CrossRef
14. Holdaway IM, Bolland MJ, Gamble GD. A Meta-Analysis of the Effect of Lowering Serum Levels of GH and IGF-I on Mortality in Acromegaly. Eur J Endocrinol. 2008;159(2):89-95. PubMed | CrossRef
15. Ershadinia N, Tritos NA. Diagnosis and Treatment of Acromegaly: an Update. Mayo Clin Proc. 2022;97(2):333-346. PubMed | CrossRef
16. Jallad RS, Shimon I, Fraenkel M, Medvedovsky V, Akirov A, Duarte FH, et al. Outcome of Pregnancies in a Large Cohort of Women with Acromegaly. Clin Endocrinol. 2018;88(6):896-907. PubMed | CrossRef
17. Katznelson L, Laws Jr ER, Melmed S, Molitch ME, Murad MH, Utz A, et al. Acromegaly: an Endocrine Society Clinical Practice Guideline. J Clin Endocrinol Metab. 2014;99(11):3933-51. PubMed | CrossRef
18. Dimaraki EV, Jaffe CA, DeMott-Friberg R, Chandler WF, Barkan AL. Acromegaly with Apparently Normal GH Secretion: Implications for Diagnosis and Follow-up. J Clin Endocrinol Metab. 2002;87(8):3537-42. PubMed | CrossRef
19. Butz LB, Sullivan SE, Chandler WF, Barkan AL. "Micromegaly": an Update on the Prevalence of Acromegaly with Apparently Normal GH Secretion in the Modern Era. Pituitary. 2016;19:547-51. PubMed | CrossRef
20. Slater G, Slater T. Articular Cartilage-a Literature Review. J Regen Biol Med. 2022;4(1):1-0. CrossRef
21. Chanson P, Salenave S. Acromegaly. Orphanet J Rare Dis. 2008;3(1):1-7. PubMed | CrossRef