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Diagnosis of Inherited Metabolic Disease in Older Patients: A Systematic Literature Review

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ABSTRACT

Inherited metabolic diseases (IMDs) are genetic disorders that disrupt biochemical processes in the human body, due to pathogenic variants in genes encoding enzymes or transporters. While IMDs are mostly diagnosed in infancy or childhood, there is an increasing number of diagnoses in adult patients. Delayed diagnosis, particularly in older patients, may reflect the diagnostic odyssey usually observed in rare diseases' patients and can result in complications and reduced quality of life for patients and their families. The aim of the study was to better characterize the diagnosis of IMDs in older patients (≥ 65 years). We conducted a systematic literature review (SLR) to examine the diagnosis and clinical presentation of IMDs in patients aged 65 and older. We searched databases like PubMed, Embase, and Lilacs for relevant studies from 1965 to 2023. A total of 260 articles were included, representing 293 patients with a median age of 69 years at diagnosis. From this SLR, 67 different diagnoses have been reported. The most frequently reported diseases were Fabry disease, alkaptonuria, Gaucher disease, mitochondrial disorders, and glycogen storage disease type V. Median diagnostic delay was 14.5 years with a wide range of 1–91 years. Musculoskeletal symptoms were the most frequently reported, followed by neurological and cardiovascular symptoms. Our findings underscore the importance of recognizing IMDs in older patients and the need for awareness among healthcare providers to improve diagnosis and patient care. Future guidelines and teaching programs should incorporate metabolic investigations for older patients presenting with symptoms suggestive of IMDs.

1 | Introduction

Inherited metabolic diseases (IMDs) are a group of genetic disorders that disrupt complex biochemical processes of the human body. These conditions are mostly due to variants in specific genes encoding essential enzymes or transporters involved in the synthesis or catabolism of biochemical compounds [1]. The result is often a cascade of clinical symptoms

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that can vary widely depending on the specific error of metabolism. Symptoms of IMD may include neurological and muscular symptoms, as well as growth and developmental deficiencies, but they can impact any system or organ. Diagnosis of IMDs is more common in newborns, infants, and children, as the symptoms often manifest early in life. However, so-called "late onset" forms of IMDs exist, and as a result, the number of adult patients diagnosed with IMD has increased over time [2]. Usually, suspicions of late onset IMD concern mostly young and middle-aged adults. However, the probability of diagnoses in older patients should be examined. From our clinical experience, diagnosis of IMDs can be made at any age, even in patients over 80 years [3]. Indeed, an article published in 1965 documented primary oxalosis in an elderly man, highlighting that metabolic genetic disorders can also present later in life [4]. This finding expanded the understanding of IMDs and broadened the scope of clinical awareness for all age groups.

In 2016, Sirrs et al. published an international survey of adult metabolic centers, which showed that, out of approximately 2000 patients, more than 40% were diagnosed in adulthood [5]. This publication demonstrated the importance of developing the field of adult metabolic medicine. However, specific data about older adult patients remain scarce. This lack of data poses significant challenges for accurate diagnosis and effective treatment of IMD in this growing population. Delayed diagnosis of IMD in older adults can lead to complications and significantly impact their quality of life [6]. Understanding the epidemiology and clinical manifestations of IMDs in older patients appears to be crucial for optimizing patient care, raising awareness among physicians, and identifying new areas for research.

In order to get new insights about the diagnosis of IMDs in older patients, we conducted a systematic review of the literature (SLR). The primary aim of our study was to identify which IMDs have been reported in older patients, for those 65 years of age and over. The secondary aim of the study was to determine the main symptoms that lead to a diagnosis of IMD in older patients.

2 | Methods

This SLR followed the preferred reporting items for systematic reviews and meta-analyses (PRISMA) 2020 checklist [7].

2.1 | Search Strategy and Search Terms

Searches of electronic databases were carried out on 19 March 2023. Databases searched were PubMed, Embase, and Lilacs from 1965 to 2023. The following search terms were used: ("Metabolism, Inborn Errors" [Mesh] OR (Errors Metabolism, Inborn) OR (Errors Metabolisms, Inborn) OR (Inborn Errors Metabolism) OR (Inborn Errors Metabolisms) OR (Metabolisms, Inborn Errors) OR (Metabolism Errors, Inborn) OR (Error, Inborn Metabolism) OR (Errors, Inborn Metabolism) OR (Inborn Metabolism Error) OR (Inborn Metabolism Errors) OR (Metabolism Error, Inborn) OR (Inborn Errors of Metabolism) OR (Metabolism Inborn Error) OR (Metabolism Inborn Errors)) AND ("aged" [Mesh] OR (Aged, 80 and over) OR (65 over) OR (elderly) OR (Frail Elderly) OR (Centenarians) OR (Nonagenarians) OR (Octogenarians)) AND ("Diagnosis" [Mesh] OR (Diagnoses) OR (Diagnose) OR (Diagnoses and Examinations) OR (Examinations and Diagnoses) OR (Diagnoses and Examination) OR (Examination and Diagnoses) OR (Screening) OR (Detection)). The reference lists of existing reviews and identified articles were examined individually using RAYYAN software. The abstracts obtained were divided into two groups. In each group, abstracts were screened by three authors working independently and matching their results. Group 1 included MRM, YMNA and MG whereas group 2 included JCM, AMA and ES. Any disagreement was resolved by a fourth person as a judge (IVDS and FM for group 1 and 2, respectively). After the harmonization of the first selection, both groups read the full papers to select those that should be included in the SLR. The flow diagram of the study selection process is depicted in Figure 1.

Inclusion criteria: (a) Age at IMD diagnosis ≥ 65 years; (b) type of study: case reports, case series, cohort studies, systematic literature reviews, screening studies; (c) language: English, Italian, French, Portuguese, Spanish, and Dutch.

Exclusion criteria: (a) Articles about diseases that did not belong to the list of the international classification of inherited metabolic disorders [1]; (b) type of study: narrative reviews, experimental studies, non-humans; (c) "common" metabolic conditions: gout, amyloidosis, hemochromatosis, G6PD, diabetes, hyperlipidemia.

2.2 | Descriptive Analysis of Patients

Diseases were counted and ranked according to the number of identified patients, from the most to the less frequently reported. A specific subgroup analysis was performed for the most frequently reported disease identified in older patients through the SLR. When the age of diagnosis and age of first symptoms were both available in selected papers, diagnostic delay was calculated. From the selected papers, symptoms and clinical signs (general, dermatological, cardiovascular, ophtalmological, neurological, musculoskeletal, bone symptoms, psychiatric, gastrointestinal, genito-urinary, hematological, renal insufficiency, ontological, respiratory, dysmorphic features) as well as electrolyte disturbances and abnormality of acid–base homeostasis were tagged as "symptoms" and then were classified into categories and further ranked from 1 to 4, with 1 being the presenting symptom of the disease, followed by three other main symptoms.

2.3 | Statistical Methods

Descriptive statistics were used. Quantitative variables were tested regarding the normal distribution by the Shapiro–Wilk test. Asymmetrical variables were presented as median ± interquartile range (Q1, Q3). All the statistics were performed using Statistics Kingdom online (https://www.statskingdom.com/mean-median-mode-calculator.html).

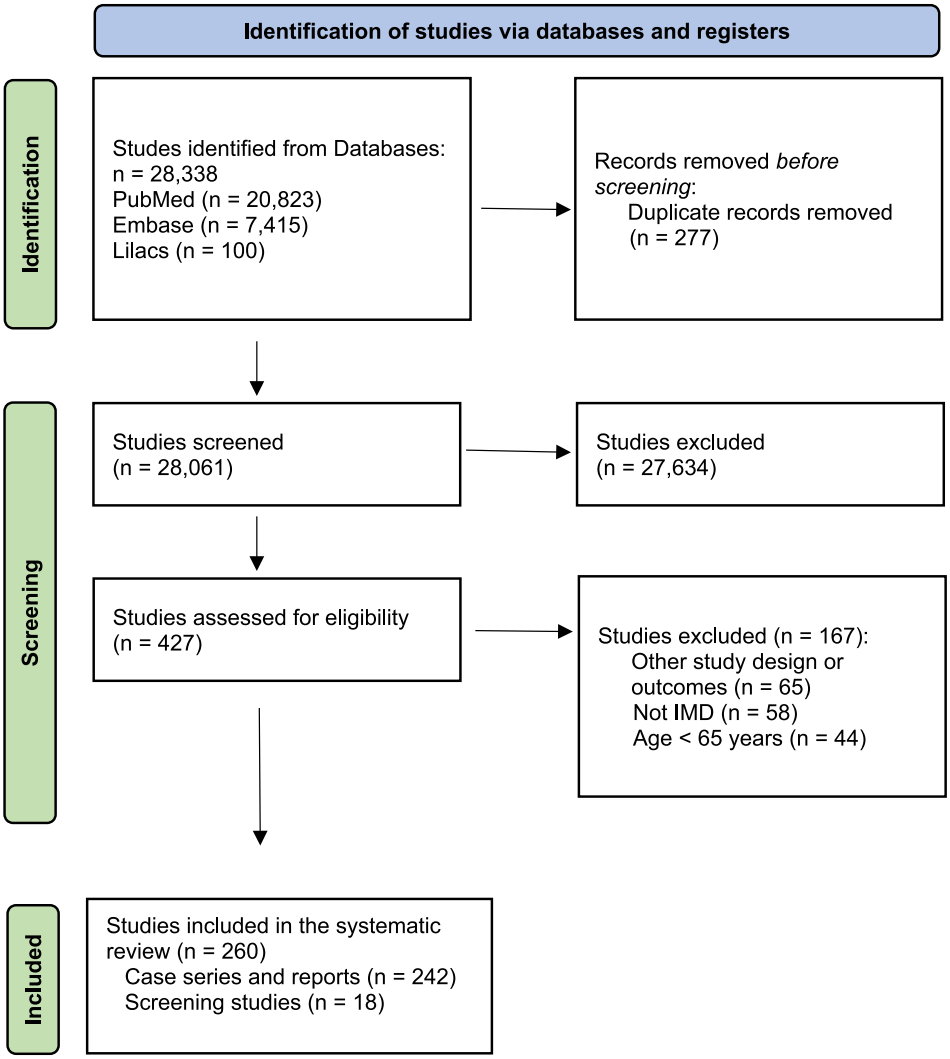

FIGURE 1 | Flow diagram of the study selection process.

3 | Results

3.1 | Study Selection

The initial searches identified 28 338 citations. After removing duplicates ($n = 277$), 28 061 potentially relevant articles were assessed using title and abstract review. A total of 428 articles were identified for full text assessment. After screening the full texts, we included 260 articles [3, 8–266] representing 242 case reports (CR) and case series (CS) and 18 screening studies (SS) (Figure 1).

3.2 | Descriptive Analysis of Patients

From the 260 selected articles, 293 patients were identified. Patients selected from CR/CS and SS are presented in Tables S1 and S2, respectively. For the whole population, median age at diagnosis was 70 ± 7 years [67–74]. The two oldest reported patients were diagnosed at the age of 92 years. One was diagnosed with Hermansky–Pudlak syndrome, and the other with Fabry disease (FD) in a selective SS of male patients with left ventricular hypertrophy. In total, 64 different diseases have been identified. FD was the most frequent disease in our study ($n = 66$), but 44% of these patients were diagnosed through selective SS. The second most frequently reported IMD was alkaptonuria ($n = 54$), followed by mitochondrial disorders ($n = 21$), Gaucher disease (GD; $n = 17$), glycogen storage disease (GSD) type V (GSD 5; $n = 13$), GSD type II ($n = 10$), hypophosphatasia ($n = 7$) and Wilson disease ($n = 6$). All the diseases identified in our SLR are presented in Table 1.

The age of onset of the first symptoms was below 65 years old for most of the patients, and the median diagnostic delay was calculated at 14.5 ± 22 years [5, 27]. Patients with FD are described in a subgroup analysis (see below). Considering patients not diagnosed through SS, alkaptonuria was then the most frequently reported disease in our study, which included 54 patients (27 women and 27 men). Clinical presentations of diagnosed patients not included by SS studies as well as symptoms relations are depicted as heatmaps in Figures 2 and 3, respectively. Musculoskeletal symptoms were the first symptoms most commonly reported, followed by neurological and cardiovascular symptoms. From Figure 3, the association of musculoskeletal symptoms and dermatological symptoms appeared to be the most prevalent.

TABLE 1 | All diseases identified in the systematic review ($n = 64$).

Disease	*n*
Fabry disease	66
Alkaptonuria	54
Gaucher disease type I	17
Glycogen storage disease type V	12
Glycogen storage disease type II	10
MELAS syndrome	10
Hypophosphatasia	7
Wilson disease	6
Cerebrotendinous xanthomatosis	5
Multiple acyl-CoA dehydrogenase deficiency	5
Tangier disease	5
Neutral lipid storage disease	4
Niemann-Pick disease type C	4
Ornithine transcarbamylase deficiency	4
X-linked Adrenoleukodystrophy	4
Acid sphingomyelinase deficiency type B	3
Hermansky-Pudlak syndrome	3
Leber hereditary optic neuropathy	3
POLG related disorder	3
Polyglucosan body disease	3
Glucose transporter type I deficiency syndrome	3
Glycogen storage disease type XV	3
Acute intermittent porphyria	2
Carnitine palmitoyltransferase type II deficiency	2
Citrullinemia type II	2
Congenital adrenal hyperplasia (17α-hydroxylase deficiency)	2
Congenital adrenal hyperplasia (21-hydroxylase deficiency)	2
Glycogen storage disease type IX	2
Krabbe disease	2
Leigh syndrome	2
Lipoprotein lipase deficiency	2
MERFF syndrome	2
Multiple DNA mitochondrial deletions	2
Porphyria cutanea tarda	2
Primary hyperoxaluria	2
Xanthinuria type I	2
X-linked ichthyosis	2
Aceruloplasminemia	1
Adenine phosphoribosyltransferase deficiency	1
Alexander disease	1
Carbamoylphosphate synthetase deficiency	1
Congenital bile acid synthesis defect type IV	1
Coproporphyria	1
Gitelman syndrome	1
Glycogen storage disease type III	1
Glycogen storage disease type VII	1
GM2 Gangliosidosis	1
Hereditary butyrylcholinesterase deficiency	1
Hereditary fructose intolerance	1
Hereditary renal hypouricemia type I	1
HHH syndrome	1
Hypophosphatemic rickets	1
Lecithin-cholesterol acyltransferase deficiency	1
Lesch–Nyhan syndrome	1
Mucopolysaccharidosis type IIIa	1
Mucopolysaccharidosis type IIIb	1
Mucopolysaccharidosis type IVb	1
Polyglucosan body myopathy type II	1
Primary muscle carnitine deficiency	1
Primary trimethylaminuria	1
Respiratory chain complex I defect	1
Sandhoff disease	1
Schindler disease	1

Abbreviations: HHH syndrome = Hyperornithinemia, Hyperammonemia, and Homocitrullinuria Syndrome; MELAS = mitochondrial encephalomyopathy, lactic acidosis, stroke-like episodes; MERRF = myoclonic epilepsy with ragged red fibers; POLG = polymerase gamma.

3.3 | Subgroup of Patients With Fabry Disease

As FD was the most frequent disease identified in our SLR, we performed a subgroup analysis of these patients. Among 66 patients diagnosed with FD, 37 (56%) and 29 (44%) patients were reported in CR and SS, respectively. Female patients represented 18/37 (49%) and 15/29 (52%) patients from CR and SS, respectively. Median age at diagnosis of patients from CR and SS was 70 ± 9 [67, 76] and 74 ± 3 [72, 75] years, respectively. The clinical pictures of these both groups are described in Figure 4. Briefly, as compared to patients reported in SS, FD from CR had more general symptoms (8% vs. 0%), respiratory symptoms (8% vs.

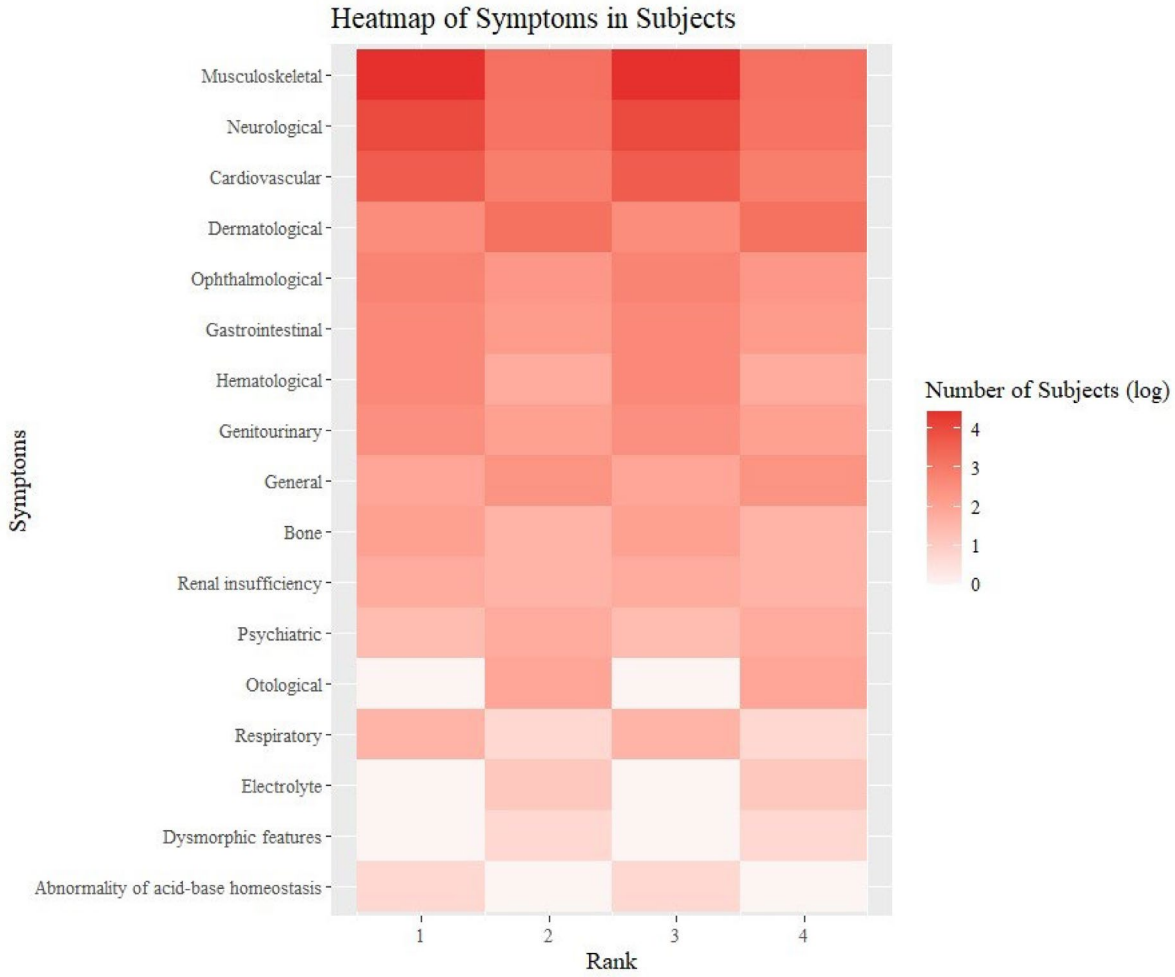

FIGURE 2 | Frequency of the first, second, third and fourth symptoms reported by the patients included in the systematic review. Rank 1: First reported symptom; 2: Second reported symptom; 3: Third reported symptom; 4: Fourth reported symptom.

0%), ophthalmological symptoms (19% vs. 7%) as well as musculoskeletal symptoms (11% vs. 3%).

4 | Discussion

The present study presents novel data from a SLR about the diagnosis of IMD in elderly people, and to our knowledge, this is the first study of its kind. The main finding of this SLR is that many IMDs can be diagnosed at 65 years of age and over. Indeed, 64 different diseases have been identified, including very rare IMDs and some unexpected diseases which are usually diagnosed in newborns or young children. FD and alkaptonuria were the most frequently diagnosed diseases in our study. From this SLR, we were also able to extract data about the clinical presentations of the numerous published cases, which bring new insights about metabolic medicine in adults. Altogether, these findings underscore the importance of not limiting metabolic investigations to younger patients and draw attention to the fact that health professionals who care for adults and older patients should be able to identify the main clinical manifestations of IMDs in this population.

The other interesting finding of the study is the diagnostic delay reported in patients reported in CS/CR (not in SS). Median diagnostic delay was almost 15 years but with a wide range, from 1 to 91 years. The 91 years delay is a case of a patient with Hermansky-Pudlak syndrome who was symptomatic since the age of 1 year with a diagnosis confirmation at the age of 92 years [166]. Besides this exceptional case, mean diagnostic delay that we observed reflects the diagnostic odyssey of patients with IMD and rare diseases in general [266]. Diagnostic delay observed in our study may correspond to several explanations. First, it reflects that IMDs in adults and older persons are still unrecognized by healthcare professionals. Second, due to their age, patients included in our study may reflect a period of time when rare diseases centers, including reference centers for IMD, were not as developed as today. Another explanation could be that affected patients may have presented mild forms of IMD due to specific genetic variants. Indeed, in some diseases, genetic variants are known to be associated with late onset forms. In FD, for example, some *GLA* variants have been associated with late onset forms of the disease [267, 268]. However, it is of note that late diagnosed patients do not include only cases of mild forms of IMD. As an example, our SLR has identified a patient diagnosed through family screening with a Lesch–Nyhan variant syndrome at the age of 65 years. Out of the three affected family members in this report, the oldest patient was the most severely affected [180], showing that he has been misdiagnosed for many years. One other potential explanation of some very

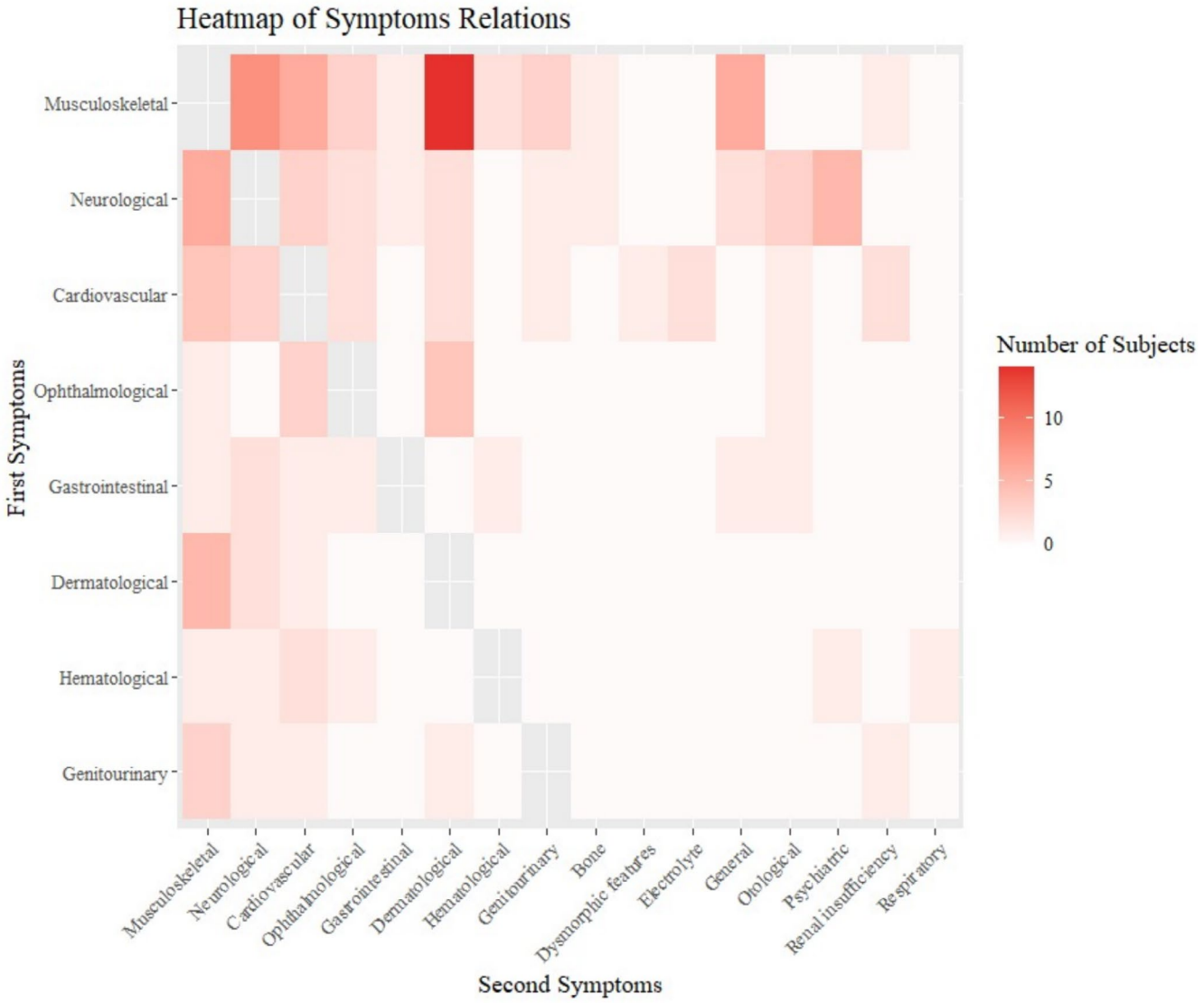

FIGURE 3 | Relations between the first and the second symptoms reported by the patients included in the SLR.

long diagnostic delays relies on patients' adaptation to the handicap related to the underlying disease. The present SLR has included a patient that we have already reported with a very late diagnosis of GSD type 5, at the age of 82 years [3]. The story of this patient is remarkable as he has continuously adapted his personal and professional life to his muscular disability. As a result, he never complained to any doctor and was diagnosed with typical GSD type 5 in the context of the investigation of persistent elevated CK following statin withdrawal after coronary bypass surgery.

The highest number of patients diagnosed through selective SS are those affected by FD. This is not surprising as many industry-sponsored screening studies for FD have been published to date, including patients with hypertrophic cardiomyopathy, kidney disease, or stroke. For FD patients diagnosed by screening or reported in CS/CR, cardiovascular symptoms were predominant, but some differences appeared between groups. Indeed, the analysis of symptoms in patients diagnosed with FD not by screening gives a more comprehensive picture of clinical symptoms leading to FD disease in the elderly. As such, it appears that beyond cardiovascular, renal, or neurological symptoms, older patients may present with musculoskeletal, respiratory, or general symptoms. It would be interesting to determine whether these clinical forms are related to some specific variants of FD.

From our SLR, we were able to identify the main symptoms of IMDs in older people. Our heatmap analysis of symptoms suggests that musculoskeletal symptoms are a hallmark of IMDs in older patients (Figure 2). This finding is explained by the most frequent diseases identified in our SLR, including FD, alkaptonuria, GD, mitochondrial disorders, and GSD type II, as these diseases may present with musculoskeletal symptoms. Such results suggest that clinicians should include investigation of IMDs in the diagnostic work-up of older patients with musculoskeletal symptoms. At the second and third ranks of our heatmap, we observed neurological and cardiovascular symptoms, respectively. Such symptoms are also representative of the most frequent diseases included in the present study. Regarding our heatmap analysis of symptom relations, our main finding is that the association of musculoskeletal symptoms with dermatological symptoms could suggest an IMD. Obviously, such association corresponds

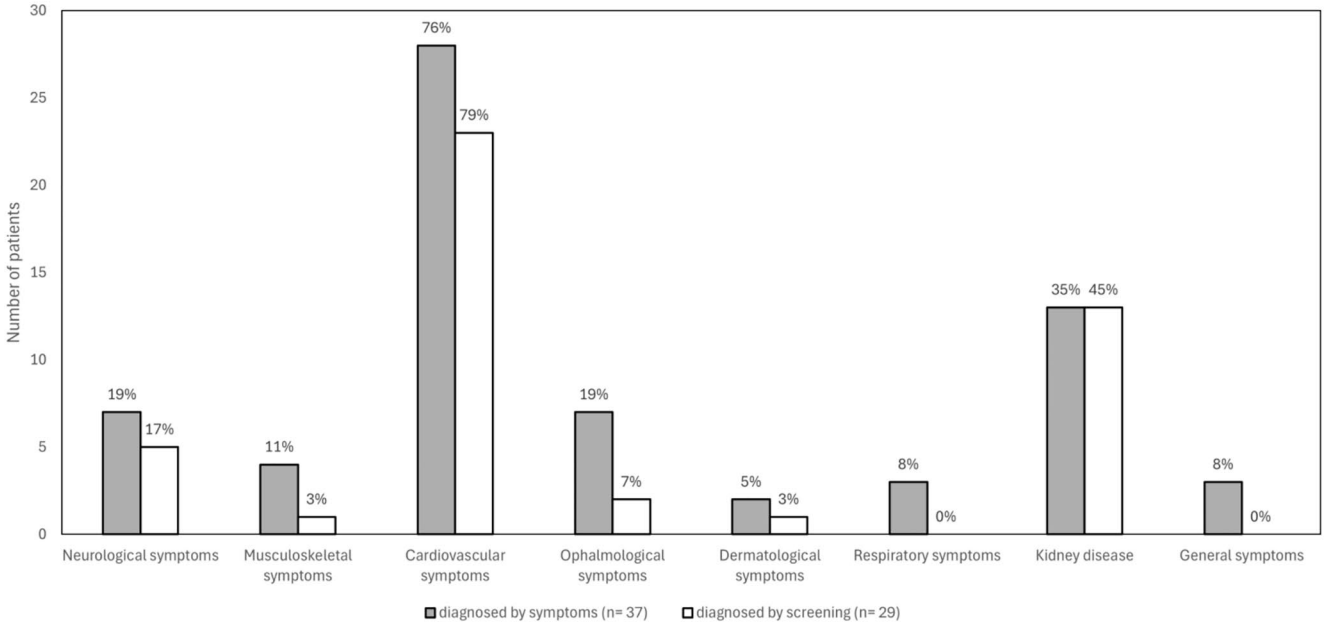

FIGURE 4 | Clinical picture of older patients diagnosed with Fabry disease ($n = 66$).

to both diagnoses of FD and alkaptonuria, which strengthens the concept that these diseases should be more often investigated in older patients. Finally, our analysis does not allow us to determine whether there are some specific pictures of IMDs in older patients but raises awareness about which clinical symptoms could indicate an IMD in this group of patients.

Considering only patients reported in CR/CS, alkaptonuria was the most reported IMD in our SLR, although this is a very rare disease that affects from 1/250 000 to 1 000 000 people worldwide [269]. Alkaptonuria is due to 1,2 dioxygenase deficiency linked to *HGD* gene variants. This is a slowly progressive disease affecting mostly joints, spine, cardiac valves, as well as the urogenital system, due to progressive homogentisic acid deposits in the connective tissues. Ophtalmological and skin changes are also part of the clinical picture of alkaptonuria. Thus, the disease is characterized by a latency period, and the onset of symptoms is usually at 30–40 years [269] but may be later in life, as shown in our study. Whatever the age, alkaptonuria is a treatable disease that requires medications including pain killers and nitisinone, along with a low protein diet, physical therapy, and orthopedic or cardiac surgery if necessary [270]. It is of note that it has been recently shown that nitisinone improves both quality of life and function of patients with alkaptonuria [271]. From our experience, we recommend prescribing nitisinone even in older patients suffering from alkaptonuria, with a close attention to any side effects that may occur.

Beyond the most frequent diseases that were described in our results, our SLR has identified a significant number of other IMDs diagnosed in older patients. This included different forms of porphyrias, acid sphingomyelinase deficiency, urea cycle disorders, cerebrotendinous xanthomatosis (CTX), rare forms of GSDs, Hermansky-Pudlak syndrome, hypophosphatasia, some types of mucopolysaccharidosis, multiple acyl-CoA dehydrogenase deficiency, polyglucosan body disease, Tangier disease, X-linked adrenoleukodystrophy, and other diseases that have been reported only once in our literature search (Table 1). Isolated cases do not necessarily mean that single reports are related to the incidence but to the natural history of diseases which commonly present with symptoms in children or young adults and not in older people. As an example, CTX, which is an autosomal recessive disorder of bile acid synthesis due to pathogenic variants in the cytochrome P450 CYP27A1 gene, has a slowly progressive course in which symptom onset varies from childhood to late adulthood [272] but can also be diagnosed in older subjects, as shown in our SLR. Some other IMDs have not been reported in the present study. We have not identified any case of phenylketonuria (PKU), which is one of the most frequent IMDs. This result could be explained by the existence of a systematic newborn screening (NBS) for PKU in many countries. However, late diagnosis of PKU is still possible in (1) people born before NBS implementation, (2) people born in countries where NBS is not effective or does not exist at all. We can hypothesize that late diagnosis of PKU is made in patients before the age of 65 years or that these cases are not published.

The present study has some strengths and limitations. The main strength of this SLR relies on the fact that we used a rigorous methodology, following the preferred reporting items for systematic reviews and meta-analyses (PRISMA) 2020 checklist [7]. The main limitation of our study is the question of whether patients and diseases reported in the literature are representative or not of the real picture of IMDs in older patients, due to potential underreporting of metabolic geriatric cases and due to the risk for publication bias. There is also a diagnostic bias when we compare rare diseases with high costs treatments versus no treatment/low cost treatments—that is why we made the choice to split the included papers in two groups, the "SS" papers (usually funded by industry) versus "non SS, symptomatic" papers. It is clear from our results that the high prevalence of Fabry and GSD II in elderly was also driven by industry efforts. However, even when we excluded the SS studies from the analysis of symptoms, musculoskeletal symptoms were the most

frequently reported, emphasizing their importance as a red flag for IMD suspicion in elderly. It is also worthy to point out that the use of the MeSH term "inborn error metabolism," instead of the specific name of each IMD, can led to the non-identification of papers which do not use the term "inborn error metabolism" as a MeSH term. This emphasizes the importance that the authors always select the most appropriate MeSH terms for your paper. Regarding the extraction of clinical data, we have to acknowledge a heterogeneous quality of papers, including some papers being published in so-called "predatory journals" [273]. Moreover, clinical descriptions of case reports appeared to be also dependent of the specialty of the publishing team. Indeed, neurologists focus more on neurological aspects, dermatologists on skin lesions and so on. Thus, such heterogeneity to report patients might have influenced the analysis of clinical data that we have extracted from the selected papers.

In summary, the present SLR has identified a significant number of IMDs that can be diagnosed in older patients, from 65 years and over and sometimes in very old patients. This result indicates that clinical investigations for IMD in adults should not be limited to younger patients. Indeed, age should not be a barrier to limit diagnostic procedures for IMD as personalized therapy may help to ameliorate the quality of life of affected persons. Musculoskeletal symptoms, eventually associated with skin changes, appear to be a good field of investigations, but a wide range of symptoms could drive the clinicians to think about an IMD in older patients. A geriatric metabolic medicine could be developed in reference centers for IMD, in order to (1) develop diagnostic procedures in older people, (2) give the best care to patients with IMD as they get older. To date, specific education and training have been developed in the field of adult metabolic medicine [274]. We suggest that some knowledge dedicated to older patients should be added to the training competencies of physicians involved in adult metabolic medicine [275]. Finally, a geriatric metabolic medicine discipline could also be developed.

Acknowledgments

The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

References

1. C. R. Ferreira, S. Rahman, M. Keller, J. Zschocke, and ICIMD Advisory Board, "An International Classification of Inherited Metabolic Diseases," *Journal of Inherited Metabolic Disease* 44 (2021): 164–177, https://doi.org/10.1002/jimd.12348.

2. F. Mochel, "What Can Pediatricians Learn From Adult Inherited Metabolic Diseases?," *Journal of Inherited Metabolic Disease* 47 (2024): 876–884, https://doi.org/10.1002/jimd.12729.

3. A. A. Fouchard, P. Corcia, C. Allais, H. Blasco, B. De Toffol, and F. Maillot, "Inborn Errors of Metabolism in Elderly Adults," *Journal of the American Geriatrics Society* 64, no. 9 (2016): 57–58, https://doi.org/10.1111/jgs.14333.

4. J. W. Koten, C. van Gastel, E. J. D. Mees, L. W. J. Holleman, and R. D. Schuiling, "Two Cases of Primary Oxalosis," *Journal of Clinical Pathology* 18, no. 2 (1965): 223–229, https://doi.org/10.1136/jcp.18.2.223.

5. S. Sirrs, C. E. M. Hollak, M. Merkel, et al., "The Frequencies of Different Inborn Errors of Metabolism in Adult Metabolic Centres: Report From the SSIEM Adult Metabolic Physicians Group," *JIMD Reports* 27 (2016): 85–91, https://doi.org/10.1007/8904_2015_435.

6. P. Kruszka and D. Regier, "Inborn Errors of Metabolism: From Preconception to Adulthood," *American Family Physician* 99, no. 1 (2019): 25–32.

7. M. J. Page, J. E. McKenzie, P. M. Bossuyt, et al., "The PRISMA 2020 Statement: An Updated Guideline for Reporting Systematic Reviews," *BMJ* 372 (2021): n71, https://doi.org/10.1136/bmj.n71.

8. R. Kassubek, I. Uttner, C. Schönfeldt-Lecuona, J. Kassubek, and B. J. Connemann, "Extending the Aceruloplasminemia Phenotype: NBIA on Imaging and Acanthocytosis, Yet Only Minor Neurological Findings," *Journal of the Neurological Sciences* 376 (2017): 151–152, https://doi.org/10.1016/j.jns.2017.03.019.

9. N. Chebib, F. Thivolet-Bejui, and V. Cottin, "Interstitial Lung Disease Associated With Adult Niemann-Pick Disease Type B," *Respiration* 94 (2017): 237–238, https://doi.org/10.1159/000477465.

10. B. Foucher and L. Vila, "Bone Marrow Smear Examination in the Diagnosis of Niemann-Pick B Disease," *Blood* 128 (2016): 738, https://doi.org/10.1182/blood-2016-04-710988.

11. A. Poulos, K. Beckman, D. H. Ellis, and A. C. Pollard, "Hepatic Storage of Bis(Monoacylglycerol) Phosphate Without Concomitant Storage of Sphingomyelin in a 72-Year-Old Patient With a Partial Deficiency of Sphingomyelinase," *Clinical Genetics* 22 (1982): 234–243, https://doi.org/10.1111/j.1399-0004.1982.tb01440.x.

12. N. Rad and S. R. Beydoun, "Porphyria-Induced Recurrent Quadriplegia Misdiagnosed as Guillain-Barré Syndrome," *US Neurology* 16 (2020): 66, https://doi.org/10.17925/usn.2020.16.1.66.

13. N. Toma, M. M. Stancu, and O. Savu, "Late Acute Intermittent Porphyria Attack in A Patient With Type 2 Diabetes," *Romanian Journal of Diabetes Nutrition And Metabolic Diseases* 22 (2015): 125–131, https://doi.org/10.1515/rjdnmd-2015-0016.

14. A. Oomatia, P. Dupont, P. Bass, and S. Moochhala, "The Case|Shining a Light on an Unusual Case of Chronic Kidney Disease," *Kidney International* 93 (2018): 1023–1024, https://doi.org/10.1016/j.kint.2017.08.028.

15. F. Salvi, Y. Aoki, R. Della Nave, et al., "Adult Alexander's Disease Without Leukoencephalopathy," *Annals of Neurology* 58 (2005): 813–814, https://doi.org/10.1002/ana.20634.

16. K. Erraoui, K. Nassar, and S. Janani, "Ochronose: Une Observation," *La Revue de Médecine Interne* 43 (2022): 669–672, https://doi.org/10.1016/j.revmed.2022.05.003.

17. T. Kostova, Z. Batalov, R. Karalilova, and A. Batalov, "Ochronotic Arthropathy in the Context of Spondyloarthritis Differential Diagnosis: A Case-Based Review," *Rheumatology International* 42 (2022): 2277–2282, https://doi.org/10.1007/s00296-022-05191-4.

18. L. Gómez- Lechón Quirós, C. Hidalgo Calleja, M. E. Acosta de la Vega, O. Compán Fernández, S. Pastor Navarro, and C. Montilla Morales, "Family History of Ochronotic Arthropathy," *Rheumatology International* 41 (2021): 1869–1874, https://doi.org/10.1007/s00296-020-04640-2.

19. Y. Kitahara, N. Kaku, H. Tagomori, and H. Tsumura, "Alkaptonuria With Rapidly Destructive Arthropathy of the Hip: A Case Report and Literature Review," *Acta Orthopaedica et Traumatologica Turcica* 55 (2021): 563–568, https://doi.org/10.5152/j.aott.2021.21205.

20. K. Butt and K. Accola, "A Man in His Early 70s With Aortic Stenosis and Discoloration of the Aortic Valve," *JAMA Cardiology* 4 (2019): 1172, https://doi.org/10.1001/jamacardio.2019.3301.

21. P. C. Gupta, R. Balamurugan, and J. Ram, "Ocular and Systemic Manifestations of Alkaptonuria," *QJM* 112 (2019): 369, https://doi.org/10.1093/qjmed/hcy268.

22. K. Nemeth and S. N. Tolkachjov, "Recognition of Alkaptonuria During Mohs Micrographic Surgery," *Dermatologic Surgery* 45 (2019): 1194–1195, https://doi.org/10.1097/DSS.0000000000001671.

23. M. Okutucu, M. G. Aslan, H. Findik, and G. Yavuz, "Glaucoma With Alkaptonuria as a Result of Pigment Accumulation," *Journal of Glaucoma* 28 (2019): e112–e114, https://doi.org/10.1097/IJG.0000000000001208.

24. M. Planinc, D. Unic, D. Baric, et al., "The Dark Side of the Heart: Cardiovascular Manifestation of Ochronosis," *Annals of Thoracic Surgery* 108 (2019): e257–e259, https://doi.org/10.1016/j.athoracsur.2019.02.042.

25. S. Yucetas and N. Ucler, "Black-Colored Ligamentum Flavum due to Alkaptonuria," *Journal of Neurological Surgery Part A: Central European Neurosurgery* 80 (2019): 131–133, https://doi.org/10.1055/s-0038-1675784.

26. R. Hakim, N. Rozen, A. Zatkova, J. Krausz, I. Elmalah, and R. Spiegel, "Degenerative Osteoarthritis With Multiple Joint Arthroplasties due to Alkaptonuria, a Rare Inborn Error of Tyrosine Metabolism," *IMAJ* 20 (2018): 260–261.

27. A. Karadag, E. Sandal, E. H. Middlebrooks, and M. Senoglu, "Surgical Management in Cervical Spondylotic Myelopathy due to Alkaptonuria," *World Neurosurgery* 113 (2018): 308–311, https://doi.org/10.1016/j.wneu.2018.02.148.

28. K. Muttardi, A. Rubin, and V. L. Brown, "A Patient With Blue Ears," *JAMA Dermatology* 152 (2016): 465–466, https://doi.org/10.1001/jamadermatol.2015.4861.

29. M. J. Schuuring, B. Delemarre, A. M. Keyhan-Falsafi, and I. A. van der Bilt, "Mending a Darkened Heart," *Circulation* 133 (2016): E444–E445, https://doi.org/10.1161/CIRCULATIONAHA.115.020194.

30. N. P. Gubbels, M. H. Sijbrand, and R. Onstenk, "Black Urine or Black Sclera of the Eyes? Consider Alkaptonuria," *Nederlands Tijdschrift Voor Geneeskunde* 157 (2014): A6684.

31. T. Hamada, T. Yamamoto, J. i. Shida, A. Inokuchi, and T. Arizono, "Subchondral Insufficiency Fracture of the Femoral Head in a Patient With Alkaptonuria," *Skeletal Radiology* 43 (2014): 827–830, https://doi.org/10.1007/s00256-013-1796-z.

32. Y. Isa, S. i. Nihei, Y. Irifukuhama, et al., "A Rare Case of Acquired Methemoglobinemia Associated With Alkaptonuria," *Internal Medicine* 53 (2014): 1797–1800, https://doi.org/10.2169/internalmedicine.53.1938.

33. T. L. Mwambingu and G. Hide, "Case 208: Alkaptonuria," *Radiology* 272 (2014): 608–611, https://doi.org/10.1148/radiol.14121842.

34. M. Vranes, I. Bilbija, A. Mikic, et al., "Aortic Valve Disease as a First Manifestation of Alcaptonuria in Surgically Treated Patient. Case Report," *Annali Italiani di Chirurgia* 85 (2014): 596–600.

35. A. Holzer, A. Leithner, and G. Gruber, "Ochronosis of the Hip Joint," *Journal of Rheumatology* 40, no. 4 (2013): 535, https://doi.org/10.3899/jrheum.121407.

36. S. G. Ong and B. C. Chen, "Alkaptonuria—More Than Meets the Eye," *Medical Journal of Malaysia* 68 (2013): 67–68.

37. S. Thakur, P. Markman, and H. Cullen, "Choice of Valve Prosthesis in a Rare Clinical Condition: Aortic Stenosis due to Alkaptonuria," *Heart, Lung & Circulation* 22 (2013): 870–872, https://doi.org/10.1016/j.hlc.2012.12.015.

38. N. Galanis and M. Kyrkos, "Brown Urine and Black Hip," *CMAJ* 184 (2012): 1600, https://doi.org/10.1503/cmaj.111916.

39. M. Baeva, A. Bueno, and P. Dhimes, "AIRP Best Cases in Radiologic-Pathologic Correlation: Ochronosis," *Radiographics* 31 (2011): 1163–1167, https://doi.org/10.1148/rg.314105175.

40. C. M. Steger, "Aortic Valve Ochronosis: A Rare Manifestation of Alkaptonuria," *BML Case Reports* 2011 (2011): bcr0420114119, https://doi.org/10.1136/bcr.04.2011.4119.

41. M. Yancovitz, R. Anolik, and M. K. Pomeranz, "Alkaptonuria," *Dermatology Online Journal* 16 (2010): 6.

42. S. Chang, E. T. Ek, and V. Pliatsios, "Black Bones: A Case of Incidental Discovery of Ochronotic Arthropathy," *Medical Journal of Australia* 190 (2009): 390, https://doi.org/10.5694/j.1326-5377.2009.tb02456.x.

43. H. Karimzadeh, N. Mohtasham, M. Karimifar, M. Salesi, and Z. S. Bonakdar, "A Case of Ochronosis With Gout and Monckeberg Arteries," *Rheumatology International* 29 (2009): 1507–1510, https://doi.org/10.1007/s00296-009-0882-y.

44. B. Zacharia, J. Chundarathil, V. Ramakrishnan, et al., "Black Hip, Fracture Neck of Femur and Scoliosis: A Case of Ochronosis," *Journal of Inherited Metabolic Disease* 32 (2009): 215–220, https://doi.org/10.1007/s10545-009-1172-2.

45. M. Brueck, D. Bandorski, W. Kramer, M. Schoenburg, S. von Gerlach, and H. Tillmanns, "Aortic Valve Stenosis due to Alkaptonuria," *Journal of Heart Valve Disease* 17 (2008): 127–129.

46. K. Oexle, K. Engel, S. Tinschert, D. Haas, and M. A. Lee-Kirsch, "Three-Generational Alkaptonuria in a Non-Consanguineous Family," *Journal of Inherited Metabolic Disease* 31 (2008): 425–430, https://doi.org/10.1007/s10545-008-0994-7.

47. M. Roser, J. Möller, T. Komoda, C. Knosalla, and P. Stawowy, "Alkaptonuric Aortic Stenosis," *European Heart Journal* 29 (2008): 444, https://doi.org/10.1093/eurheartj/ehm406.

48. H. M. El-Khushman, "Clinical Quiz. A 69-Year-Old Man With a Thick Dark Pigmentation on His Hands, and Low Back Pain," *Saudi Medical Journal* 28 (2007): 1761–1762.

49. V. Sharma, Y. Y. Chong, and A. Kosmin, "Alkaptonuria Presenting With Conjunctival Lesion," *Comprehensive Therapy* 33 (2007): 71–72, https://doi.org/10.1007/s12019-007-8010-y.

50. I. Shimizu, T. Hamada, Z. Khalpey, K. Miyanishi, and T. Hara, "Ochronotic Arthropathy: Pathological Evidence of Acute Destruction of the Hip Joint," *Clinical Rheumatology* 26 (2007): 1189–1191, https://doi.org/10.1007/s10067-006-0326-y.

51. J. W. Butany, A. Naseemuddin, Y. Moshkowitz, and V. Nair, "Ochronosis and Aortic Valve Stenosis," *Journal of Cardiac Surgery* 21 (2006): 182–184, https://doi.org/10.1111/j.1540-8191.2006.00207.x.

52. A. Gupta, A. Jayanti, and K. Prasanna, "Premature Arthritis in an Elderly Woman," *International Journal of Clinical Practice* 60 (2006): 858–860, https://doi.org/10.1111/j.1742-1241.2006.00600.x.

53. A. Ladjouze-Rezig, S. Rodriguez de Cordoba, and R. Aquaron, "Ochronotic Rheumatism in Algeria: Clinical, Radiological, Biological and Molecular Studies—A Case Study of 14 Patients in 11 Families," *Joint, Bone, Spine* 73 (2006): 284–292, https://doi.org/10.1016/j.jbspin.2005.03.010.

54. R. J. Goodfellow, J. Schwartz, and F. Leya, "BlackAorta: A Rare Finding at Aortic Valve Replacement," *Journal of Invasive Cardiology* 17 (2005): 165–167.

55. M. L. Spenny, P. Suwannarat, W. A. Gahl, and E. W. Cowen, "Blue Pigmentation and Arthritis in an Elderly Man," *Journal of the American Academy of Dermatology* 52 (2005): 122–124, https://doi.org/10.1016/j.jaad.2004.09.011.

56. E. Erek, F. R. A. Casselman, and H. Vanermen, "Cardiac Ochronosis: Valvular Heart Disease With Dark Green Discoloration of the Leaflets," *Texas Heart Institute Journal* 31 (2004): 445–447.

57. P. G. M. Maathuis and A. P. P. M. Driessen, "Painted Black," *Annals of the Rheumatic Diseases* 61 (2002): 100–101, https://doi.org/10.1136/ard.61.2.100.

58. S. Mori, T. Kawaguchi, H. Kakinuma, et al., "Alcaptonuria: A Case Complicated With Valvular Heart Disease and Immunodeficiency," *Internal Medicine* 33 (1994): 512–516, https://doi.org/10.2169/internalmedicine.33.512.

59. A. Cordero, M. Mazzini, M. Fridmanis, O. Pafume, and H. Spillman, "Alcaptonuria, Ocronosis y Artropatia Ocronotica. Evolucion de un Caso," *Archivos Argentinos de Dermatologia* 34 (1984): 217–222.

60. R. Gündüz, B. Üstün, A. Uran Şan, H. G. Karatas, and M. Akyüz, "Alkaptonuria Diagnosed in a Geriatric Patient; A Case Report," *Turkish Journal of Geriatrics* 23 (2020): 147–152, https://doi.org/10.31086/tjgeri.2020.148.

61. J. G. Parambil, C. E. Daniels, K. J. Zehr, and J. P. Utz, "Alkaptonuria Diagnosed by Flexible Bronchoscopy," *Chest* 128 (2005): 3678–3680.

62. A. A. Fisher and M. W. Davis, "Alkaptonuric Ochronosis With Aortic Valve and Joint Replacements and Femoral Fracture: A Case Report and Literature Review," *Clinical Medicine & Research* 2 (2004): 209–215, https://doi.org/10.3121/cmr.2.4.209.

63. S. Demir, "Alkaptonuric Ochronosis: A Case With Multiple Joint Replacement Arthroplasties," *Clinical Rheumatology* 22 (2003): 437–439, https://doi.org/10.1007/s10067-003-0760-z.

64. A. Alrehaily and J. E. Pope, "Alkaptonuria With Atypical Joint Involvement," *Journal of Rheumatology* 29 (2002): 198–199.

65. M. Carlesimo, P. Bonaccorsi, G. Tamburrano, I. Carboni, A. Parisi, and S. Calvier, "Alkaptonuria," *Dermatology* 199 (1999): 70–71, https://doi.org/10.1159/000018186.

66. S. Toquet, M. Spodenkiewicz, C. Douillard, et al., "Adult-Onset Diagnosis of Urea Cycle Disorders: Results of a French Cohort of 71 Patients," *Journal of Inherited Metabolic Disease* 44 (2021): 1199–1214, https://doi.org/10.1002/jimd.12403.

67. P. Esposito, L. Estienne, N. Serpieri, et al., "Rhabdomyolysis-Associated Acute Kidney Injury," *American Journal of Kidney Diseases* 71 (2018): A12–A14, https://doi.org/10.1053/j.ajkd.2018.03.009.

68. S. Corti, A. Bordoni, D. Ronchi, et al., "Clinical Features and New Molecular Findings in Carnitine Palmitoyltransferase II (CPT II) Deficiency," *Journal of the Neurological Sciences* 266 (2008): 97–103, https://doi.org/10.1016/j.jns.2007.09.015.

69. K. M. Varman, K. Dunbar, K. Usifo, and C. A. Stevens, "Cerebrotendinous Xanthomatosis: A Treatable Genetic Disease Not to be Missed," *Journal of Clinical Rheumatology* 22 (2016): 92–93, https://doi.org/10.1097/RHU.0000000000000367.

70. M. Yanagihashi, O. Kano, T. Terashima, et al., "Late-Onset Spinal Form Xanthomatosis Without Brain Lesion: A Case Report," *BMC Neurology* 16 (2016): 21, https://doi.org/10.1186/s12883-016-0542-2.

71. A. Mignarri, M. Falcini, A. Vella, et al., "Parkinsonism as Neurological Presentation of Late-Onset Cerebrotendinous Xanthomatosis," *Parkinsonism & Related Disorders* 18 (2012): 99–101, https://doi.org/10.1016/j.parkreldis.2011.06.004.

72. T. Nozue, T. Higashikata, A. Inazu, et al., "Identification of a Novel Missense Mutation in the Sterol 27-Hydroxylase Gene in Two Japanese Patients With Cerebrotendinous Xanthomatosis," *Internal Medicine* 49 (2010): 1127–1131, https://doi.org/10.2169/internalmedicine.49.3277.

73. H. Suzuki, Y. Kawamura, K. Kinowaki, et al., "The Lack of Hepatocyte Steatosis in Adult-Onset Type II Citrullinemia Patients as Assessed by 7-Year Interval Paired Biopsies," *Internal Medicine* 58 (2019): 1891–1895, https://doi.org/10.2169/internalmedicine.2374-18.

74. M. Yazaki, M. Kinoshita, S. Ogawa, et al., "A 73-Year-Old Patient With Adult-Onset Type II Citrullinemia Successfully Treated by Sodium Pyruvate and Arginine," *Clinical Neurology and Neurosurgery* 115 (2013): 1542–1545, https://doi.org/10.1016/j.clineuro.2012.12.027.

75. A. Guenego, Y. Morel, O. Ionesco, D. Mallet, and M. Priou-Guesdon, "A Late 17α-Hydroxylase Deficiency Diagnosis That Leads to the Discovery of a New CYP17 Gene Mutation," *Annales d'Endocrinologie* 76 (2015): 71–74, https://doi.org/10.1016/j.ando.2014.11.003.

76. S. Yamagata, K. Kageyama, T. Usui, et al., "Identification of a Homozygous c.1039C>T (p.R347C) Variant in CYP17A1 in a 67-Year-Old Female Patient With Partial 17α-Hydroxylase/17,20-Lyase Deficiency," *Endocrine Journal* 69 (2022): EJ21-0266, https://doi.org/10.1507/endocrj.EJ21-0266.

77. M. B. Vigliani and J. E. Buster, "Nonclassic 21-Hydroxylase Deficiency Presenting as Endometrial Hyperplasia With Uterine Bleeding in a 67-Year-Old Woman," *Fertility and Sterility* 97 (2012): 950–952, https://doi.org/10.1016/j.fertnstert.2012.01.089.

78. N. Takasu, K. Nakachi, and H. Higa, "Development of Graves' Hyperthyroidism Caused an Adrenal Crisis in a Patient With Previously Unrecognized Non-Classical 21-Hydroxylase Deficiency," *Internal Medicine* 49 (2010): 1395–1400, https://doi.org/10.2169/internalmedicine.49.3573.

79. S. H. Wang, T. C. Hui, Z. W. Zhou, et al., "Diagnosis and Treatment of an Inborn Error of Bile Acid Synthesis Type 4: A Case Report," *World Journal of Clinical Cases* 9 (2021): 7923–7929, https://doi.org/10.12998/wjcc.v9.i26.7923.

80. S. Eroglu and I. Birsenogul, "Delirium With Delayed Diagnosis of Hereditary Coproporphyria," *Clinical Case Reports* 10 (2022): e05937, https://doi.org/10.1002/ccr3.5937.

81. K. Adachi, H. Tokuyama, Y. Oshima, et al., "Fabry Disease Associated With Multiple Myeloma: A Case Report," *CEN Case Reports* 11 (2022): 146–153, https://doi.org/10.1007/s13730-021-00613-x.

82. F. R. Salerno, L. Roggero, F. Rossi, A. Binaggia, S. Bertoli, and F. Pieruzzi, "Relapsing Minimal Change Disease Superimposed on Late-Onset p.N215S Fabry Nephropathy," *Clinical Kidney Journal* 15 (2022): 171–173, https://doi.org/10.1093/ckj/sfab148.

83. T. P. Yu and J. Y. Chen, "Unexplained Left Ventricular Hypertrophy With Symptomatic High-Grade Atrioventricular Block in Elderly Patients: A Case Report," *Journal of Clinical Medicine* 11 (2022): 3522, https://doi.org/10.3390/jcm11123522.

84. S. Zhou, X. Wang, H. Xu, J. Li, L. Zhang, and H. Li, "Fabry Disease With Acute Myocardial Infarction, Left Ventricular Thrombosis, and Pericardial Effusion," *Medicine* 101 (2022): e29427, https://doi.org/10.1097/MD.0000000000029427.

85. J. Chen and C. Lin, "Late Onset Sudden Cardiac Death in Fabry Disease," *Kaohsiung Journal of Medical Sciences* 37 (2021): 72–73, https://doi.org/10.1002/kjm2.12296.

86. S. Aratani, H. Yamakawa, S. Suzuki, et al., "A Case of Female Fabry Disease Revealed by Renal Biopsy," *CEN Case Reports* 9 (2020): 24–29, https://doi.org/10.1007/s13730-019-00420-5.

87. G. De Angelis, Z. Tsoumani, A. Reid, G. Nucifora, R. B. Irwin, and M. Schmitt, "Late-Onset Fabry Disease Presenting With Ventricular Tachycardia Originating From Typical Inferolateral Scar," *Canadian Journal of Cardiology* 36 (2020): 1832.e1–1832.e4, https://doi.org/10.1016/j.cjca.2020.04.042.

88. J. Nestele, C. van den Hoven, E. M. Van Craenenbroeck, et al., "Recurrent Acute Coronary Syndrome, Polymorphic Premature Ventricular Complexes and a Son With a (Mis)diagnosis of Multiple Sclerosis," *Acta Cardiologica* 75 (2020): 467–468, https://doi.org/10.1080/00015385.2019.1616137.

89. A. R. Vanga, S. A. Schrier Vergano, J. Kowalewska, and T. R. McCune, "Previously Unidentified Gene Variation Associated With Fabry Disease: The Impact on One Family," *Case Reports in Nephrology* 2020 (2020): 8899703, https://doi.org/10.1155/2020/8899703.

90. C. Gatterer, D. Beitzke, R. Sunder-Plassmann, G. Sunder-Plassmann, and S. Graf, "First Case of Late Onset Cardiac Phenotype Fabry Disease due to an AluYb8 Insertion in Exon 7 of the GLA Gene," *European*

Heart Journal Cardiovascular Imaging 20 (2019): 1182, https://doi.org/10.1093/ehjci/jez083.

91. I. S. Visoiu, A. O. Ciobanu, A. I. Nicula, et al., "Severe Late-Onset Fabry Cardiomyopathy Unmasked by a Multimodality Imaging Approach," *Circulation. Cardiovascular Imaging* 12 (2019): e009709, https://doi.org/10.1161/CIRCIMAGING.119.009709.

92. R. Onishi, K. Kanaoka, J. Sugiura, et al., "A Cardiac Variant of Fabry Disease Diagnosed With Chance Urinary Mulberry Cells," *Internal Medicine* 57 (2018): 3385–3388, https://doi.org/10.2169/internalmedicine.1177-18.

93. B. L. Thurberg, D. P. Germain, F. Perretta, I. E. Jurca-Simina, and J. M. Politei, "Fabry Disease: Four Case Reports of Meningioma and a Review of the Literature on Other Malignancies," *Molecular Genetics and Metabolism Reports* 11 (2017): 75–80, https://doi.org/10.1016/j.ymgmr.2016.09.005.

94. W. Y. Yau, M. J. Fabis-Pedrini, and A. G. Kermode, "Fabry Heterozygote Mimicking Multiple Sclerosis," *BML Case Reports* 2017 (2017): 220274, https://doi.org/10.1136/bcr-2017-220274.

95. S. C. Cho, H. W. Yoo, J. W. Lee, J. Y. Jang, R. Heo, and J. M. Song, "Fabry Disease Presenting With Hypertrophic Cardiomyopathy and Tricuspid Regurgitation," *Journal of Cardiovascular Ultrasound* 24 (2016): 324–328, https://doi.org/10.4250/jcu.2016.24.4.324.

96. R. B. Hasselbalch, P. L. Madsen, H. Bundgaard, and J. Theilade, "Presymptomatic Diagnosis of Fabry's Disease: A Case Report," *Journal of Medical Case Reports* 10 (2016): 330, https://doi.org/10.1186/s13256-016-1124-z.

97. K. Nishimura, N. Funabashi, Y. Takahashi, et al., "Cardiac Fabry Disease With Plural Mass Fibrosis Observed in the Thickened Left Ventricular Wall," *International Journal of Cardiology* 202 (2016): 552–555, https://doi.org/10.1016/j.ijcard.2015.09.045.

98. M. Oikawa, N. Sakamoto, A. Kobayashi, et al., "Familial Hypertrophic Obstructive Cardiomyopathy With the GLA E66Q Mutation and Zebra Body," *BMC Cardiovascular Disorders* 16 (2016): 83, https://doi.org/10.1186/s12872-016-0262-y.

99. K. Nishimura, T. Uehara, H. Ishibashi-Ueda, T. Anzai, and K. Toyoda, "Cardioembolic Stroke in the Cardiac Variant of Fabry Disease," *Neurology and Clinical Neuroscience* 3 (2015): 78–80, https://doi.org/10.1111/ncn3.148.

100. Y. Tomizawa, A. Okuzumi, H. Shiotsuki, K. Noda, N. Hattori, and Y. Okuma, "A Patient With the GLA& p.E66Q Mutation Exhibiting Vascular Parkinsonism and Bilateral Pulvinar Lesions," *Internal Medicine* 54 (2015): 2503–2506, https://doi.org/10.2169/internalmedicine.54.4437.

101. J. B. Geske, H. Jouni, M. C. Aubry, and B. J. Gersh, "Fabry Disease With Resting Outflow Obstruction Masquerading as Hypertrophic Cardiomyopathy," *Journal of the American College of Cardiology* 63 (2014): e43, https://doi.org/10.1016/j.jacc.2013.07.121.

102. O. U. Ozcan, B. Tekin Tak, S. Turhan, et al., "Retarded Diagnosis of Fabry in a Geriatric Patient," *European Journal of Geriatric Medicine* 5, no. 4 (2014): 288–289, https://doi.org/10.1016/j.eurger.2014.04.004.

103. A. Zampetti, L. Fania, D. Antuzzi, et al., "Mutation Identification of Fabry Disease in Families With Other Lysosomal Storage Disorders," *Clinical Genetics* 84 (2013): 281–285, https://doi.org/10.1111/cge.12071.

104. V. Hogarth, S. Dhoat, A. B. Mehta, and C. H. Orteu, "Late-Onset Fabry Disease Associated With Angiokeratoma of Fordyce and Multiple Cherry Angiomas," *Clinical and Experimental Dermatology* 36 (2011): 506–508, https://doi.org/10.1111/j.1365-2230.2011.04053.x.

105. V. L. Sorrell, W. D. Ross, J. Gregoire, L. Lai, and Y. H. Lien, "Unexpected Severe LVH in the Elderly: Consider Fabry's Disease," *Echocardiography* 25 (2008): 345–348, https://doi.org/10.1111/j.1540-8175.2007.00608.x.

106. S. Buechner, C. Luzzi, M. Mannucci, D. Massi, and W. Borsini, "Diagnosis of Anderson-Fabry's Disease in Over Seventy-Year-Old Women: Description of Two Cases," *Aging Clinical and Experimental Research* 18 (2006): 340–343, https://doi.org/10.1007/BF03324669.

107. H. Liapsis, "Nephropathology Quiz Page. Heterozygous Fabry's Disease," *International Urology and Nephrology* 38 (2006): 361–362, https://doi.org/10.1007/s11255-006-0058-6.

108. A. O. Osunkoya, S. D. Agte, and Z. Laszik, "A 67-Year-Old Woman With Chronic Proteinuria," *Archives of Pathology & Laboratory Medicine* 130 (2006): e93–e95, https://doi.org/10.5858/2006-130-e93-AYWWCP.

109. J. Blanco, J. Herrero, L. F. Arias, N. Garcia-Miralles, C. Gamez, and A. Barrientos, "Renal Variant of Anderson-Fabry Disease and Bilateral Renal Cell Carcinoma," *Pathology, Research and Practice* 200 (2005): 857–860, https://doi.org/10.1016/j.prp.2004.09.003.

110. A. H. Jamali, R. M. Ahmed, and H. Stein, "An Unusual Cause of Dyspnea," *Cardiology in Review* 12 (2004): 10–14, https://doi.org/10.1097/01.crd.0000087211.99837.ea.

111. D. Rosenthal, Y. H. H. Lien, D. Lager, et al., "A Novel Alpha-Galactosidase a Mutant (M42L) Identified in a Renal Variant of Fabry Disease," *American Journal of Kidney Diseases* 44 (2004): e85–e89.

112. K. Hirano, K. Murata, A. Miyagawa, et al., "Histopathologic Findings of Cornea Verticillata in a Woman Heterozygous for Fabry's Disease," *Cornea* 20 (2001): 233–236, https://doi.org/10.1097/00003226-200103000-00028.

113. Y. H. H. Lien, L. W. Lai, and C. Y. Lui, "Unexpected Diagnosis of Fabry Disease in an 80-Year-Old Man With Syncope," *Cardiology* 96 (2001): 115–116, https://doi.org/10.1159/000047393.

114. T. Shirai, T. Ohtake, M. Kimura, et al., "Atypical Fabry's Disease Presenting With Cholesterol Crystal Embolization," *Internal Medicine* 39 (2000): 646–649, https://doi.org/10.2169/internalmedicine.39.646.

115. R. E. Hillsley, E. Hernandez, C. Steenbergen, T. M. Bashore, and J. K. Harrison, "Inherited Restrictive Cardiomyopathy in a 74-Year-Old Woman: A Case of Fabry's Disease," *American Heart Journal* 129 (1995): 199–202, https://doi.org/10.1016/0002-8703(95)90062-4.

116. S. Sivaloganathan, "3. Fabry's Disease—A Rare Cause of Sudden Death," *Medicine, Science, and the Law* 32 (1992): 263–266, https://doi.org/10.1177/002580249203200315.

117. M. Han, J. M. Byun, Y. Koh, S. S. Yoon, and D. Yang, "Gaucher Disease Type 1: Unexpected Diagnosis in a 75-Year-Old Patient Presenting With Splenomegaly," *Current Problems in Cancer* 45 (2021): 100708, https://doi.org/10.1016/j.currproblcancer.2021.100708.

118. N. Sgherza, A. Quarta, E. Rinaldi, A. Pasanisi, M. Brocca, and D. Pastore, "Who Seeks Finds. Gaucher's Disease: A Rare Case of Thrombocytopenia," *International Journal of Hematology* 111, no. 3 (2020): 327–328, https://doi.org/10.1007/s12185-020-02824-x.

119. R. Ruchlemer, M. Mittelman, and A. Zimran, "Gaucher Disease, Myelodysplastic Syndrome and ICUS," *Blood Cells, Molecules & Diseases* 80 (2020): 102373, https://doi.org/10.1016/j.bcmd.2019.102373.

120. S. Hosoba, K. Kito, Y. Teramoto, et al., "A Novel Mutation Causing Type 1 Gaucher Disease Found in a Japanese Patient With Gastric Cancer," *Medicine* 97 (2018): e11361, https://doi.org/10.1097/MD.0000000000011361.

121. E. Beutler, "Gaucher's Disease in an Asymptomatic 72-Year-Old," *JAMA* 237 (1977): 2529.

122. M. Machaczka, M. Klimkowska, S. Regenthal, and H. Hägglund, "Gaucher Disease With Foamy Transformed Macrophages and Erythrophagocytic Activity," *Journal of Inherited Metabolic Disease* 34 (2011): 233–235, https://doi.org/10.1007/s10545-010-9241-0.

123. X. Morandi, S. Saikali, M. Lakehal, M. Pommereuil, and A. Hamlat, "Cauda Equina Syndrome due to an Intra-Dural Sacral Cyst in Type-1

Gaucher Disease," *European Spine Journal* 13 (2004): 249–252, https://doi.org/10.1007/s00586-003-0657-1.

124. M. Z. Haran, E. Feldberg, and A. Berrebi, "Incidental Diagnosis of Gaucher's Disease in an Elderly Patient With Lymphoma," *Leukemia & Lymphoma* 40 (2001): 445–446, https://doi.org/10.3109/10428190109057948.

125. D. Neau, P. Mercier, K. Bouabdallah, et al., "A Rare Etiology of Spinal Cord Compression: Gaucher Disease," *La Revue de Médecine Interne* 14, no. 4 (1993): 260–262, https://doi.org/10.1016/s0248-8663(05)82494-4.

126. G. M. Corbett, P. J. Darbyshire, G. T. N. Besley, and A. C. Parker, "Adult Gaucher Disease in Association With Acute Leukaemia," *Postgraduate Medical Journal* 63 (1987): 899–900, https://doi.org/10.1136/pgmj.63.744.899.

127. T. Mark, C. Dominguez, and A. M. Rywlin, "Gaucher's Disease Associated With Chronic Lymphocytic Leukemia," *Southern Medical Journal* 75 (1982): 361–362, https://doi.org/10.1097/00007611-198203000-00030.

128. I. J. McKelvie and L. R. Edwards, "Gaucher's Disease: Report of as Case," *Medical Journal of Australia* 2 (1969): 297–299, https://doi.org/10.5694/j.1326-5377.1969.tb105730.x.

129. D. Vellas, B. Gramont, R. Grange, and P. Cathébras, "Pulmonary Involvement Responsive to Enzyme Replacement Therapy in an Elderly Patient With Gaucher Disease," *European Journal of Case Reports in Internal Medicine* 8 (2021): 002802, https://doi.org/10.12890/2021_002802.

130. M. R. Reynolds, D. M. Heiferman, A. B. Boucher, B. M. Howard, D. L. Barrow, and J. E. Dion, "Multiple Intracranial Aneurysms in a Patient With Type I Gaucher Disease: A Case Report and Literature Review," *British Journal of Neurosurgery* 34 (2020): 202–204, https://doi.org/10.1080/02688697.2018.1426725.

131. W. Shuai, C. E. Wagner, N. Sukswai, L. J. Medeiros, C. Bueso-Ramos, and T. H. Oo, "Gaucher Disease Type 1 First Recognized in an Elderly Patient With Thrombocytopenia and Lung Adenocarcinoma," *Clinical Case Reports* 7 (2019): 1804–1805, https://doi.org/10.1002/ccr3.2336.

132. Z. Kaleem and A. Hassan, "Multiple Lytic Bone Lesions in an 85-Year-Old Man: Type 1 Gaucher Disease, Adult Onset (Nonneuronopathic Form)," *Archives of Pathology & Laboratory Medicine* 129 (2005): e148–50, https://doi.org/10.5858/2005-129-e148-MLBLIA.

133. E. Conticini, A. Negro, L. Magnani, et al., "Gitelman Syndrome Associated With Chondrocalcinosis and Severe Neuropathy: A Novel Heterozygous Mutation in SLC12A3 Gene," *Reumatismo* 72 (2020): 67–70, https://doi.org/10.4081/reumatismo.2020.1255.

134. A. Winczewska-Wiktor, D. Hoffman-Zacharska, M. Starczewska, I. Kaczmarek, M. Badura-Stronka, and B. Steinborn, "Variety of Symptoms of GLUT1 Deficiency Syndrome in Three-Generation Family," *Epilepsy & Behavior* 106 (2020): 107036, https://doi.org/10.1016/j.yebeh.2020.107036.

135. A. Ramm-Pettersen, K. O. Nakken, K. C. Haavardsholm, and K. K. Selmer, "GLUT1-Deficiency Syndrome: Report of a Four-Generation Norwegian Family With a Mild Phenotype," *Epilepsy & Behavior* 70, no. Pt A (2017): 1–4, https://doi.org/10.1016/j.yebeh.2017.02.016.

136. J. Al-Hashel and I. Ismail, "Late-Onset Pompe Disease Presenting With Isolated Tongue Involvement," *Case Reports of Neurology* 14 (2022): 98–103, https://doi.org/10.1159/000521524.

137. H. Takano, T. Ishihara, M. Kosuga, and T. Okuyama, "A Senile Case of Late-Onset Pompe's Disease," *Internal Medicine* 55 (2016): 2723–2725, https://doi.org/10.2169/internalmedicine.55.6803.

138. T. B. Beltran Papsdorf, J. F. Howard, and N. Chahin, "Pearls & Oysters: Clues to the Diagnosis of Adult-Onset Acid Maltase Deficiency," *Neurology* 82 (2014): 73–75, https://doi.org/10.1212/WNL.0000000000000163.

139. F. B. Panosyan, M. F. Fitzpatrick, and C. F. Bolton, "Late Onset Pompe Disease Mimicking Rigid Spine Syndrome," *Canadian Journal of Neurological Sciences* 41 (2014): 286–289, https://doi.org/10.1017/s0317167100016760.

140. A. Dubrovsky, J. Corderi, T. Karasarides, and A. L. Taratuto, "Pompe Disease, the Must-Not-Miss Diagnosis: A Report of 3 Patients," *Muscle & Nerve* 47 (2013): 594–600, https://doi.org/10.1002/mus.23643.

141. R. Patil and J. L. DePriest, "Visual Hallucinations in a Patient With Adult-Onset Acid Maltase Deficiency Disorder," *Journal of General Internal Medicine* 24 (2009): 683–686, https://doi.org/10.1007/s11606-009-0923-y.

142. I. Bosone, L. Vercelli, T. Mongini, et al., "Glycogen Storage Disease Type II Diagnosed in a 74-Year-Old Woman," *Journal of the American Geriatrics Society* 52 (2004): 1034–1035, https://doi.org/10.1111/j.1532-5415.2004.52277_13.x.

143. A. M. Chancellor, C. P. Warlow, J. N. Webb, M. G. Lucas, G. T. Besley, and D. M. Broadhead, "Acid Maltase Deficiency Presenting With a Myopathy and Exercise Induced Urinary Incontinence in a 68-Year-Old Male," *Journal of Neurology, Neurosurgery, and Psychiatry* 54, no. 7 (1991): 659–660, https://doi.org/10.1136/jnnp.54.7.659.

144. I. W. Fellows, J. S. Lowe, A. L. Ogilvie, A. Stevens, P. J. Toghill, and M. Atkinson, "Type III Glycogenosis Presenting as Liver Disease in Adults With Atypical Histological Features," *Journal of Clinical Pathology* 36, no. 4 (1983): 431–434, https://doi.org/10.1136/jcp.36.4.431.

145. P. R. Chocair, S. Mohrbacher, P. D. M. de Menezes Neves, et al., "An Elderly Diabetic Patient With McArdle Disease and Recurrent Rhabdomyolysis: A Potential Association With Late Hypoinsulinemia?," *BMC Geriatrics* 20 (2020): 451, https://doi.org/10.1186/s12877-020-01812-4.

146. T. Horino, E. Amano, T. Furushima, O. Ichii, and Y. Terada, "Spondyloarthropathy Associated With Glycogen Storage Disease Type V Mimicking Polymyositis," *QJM* 112 (2019): 281–282, https://doi.org/10.1093/qjmed/hcy309.

147. C. Chéraud, R. Froissart, B. Lannes, and A. Echaniz-Laguna, "Novel Variant in the PYGM Gene Causing Late-Onset Limb-Girdle Myopathy, Ptosis, and Camptocormia," *Muscle & Nerve* 57 (2018): 157–160, https://doi.org/10.1002/mus.25588.

148. C. Diez Morrondo, L. Pantoja Zarza, and B. San Millán Tejado, "Enfermedad de McArdle: Presentación de 2 Casos clínicos," *Reumatologia Clinica* 12 (2016): 161–163, https://doi.org/10.1016/j.reuma.2015.06.003.

149. V. Cosentini, A. Cosaro, L. Gammaro, et al., "A Case of Acute Renal Failure Secondary to Late-Onset McArdle's Disease," *Giornale Italiano di Nefrologia* 30, no. 3 (2013): gin/30.3.17.

150. M. Perez, M. A. Martin, J. C. Rubio, et al., "Exercise Capacity in a 78 Year Old Patient With McArdle's Disease: It Is Never Too Late To Start Exercising," *British Journal of Sports Medicine* 40, no. 8 (2006): 725–726, https://doi.org/10.1136/bjsm.2006.026666.

151. C. Livingstone, S. Al Riyami, P. Wilkins, and G. A. Ferns, "McArdle's Disease Diagnosed Following Statin-Induced Myositis," *Annals of Clinical Biochemistry* 41, no. Pt 4 (2004): 338–340, https://doi.org/10.1258/0004563041201554.

152. G. I. Wolfe, N. S. Baker, R. G. Haller, D. K. Burns, and R. J. Barohn, "McArdle's Disease Presenting With Asymmetric, Late-Onset Arm Weakness," *Muscle & Nerve* 23 (2000): 641–645, https://doi.org/10.1002/(sici)1097-4598(200004)23:4<641::aid-mus25>3.0.co;2-m.

153. J. Colin, M. Coqueta, K. Ghit, P. Mottaza, and B. Vellas, "État Dépressif, Rhabdomyolyse et Syndrome Inflammatoire chez un Patient de 71 ans," *La Revue de Médecine Interne* 18 (1997): s303–s304, https://doi.org/10.1016/s0248-8663(97)80587-5.

154. R. Harris and R. M. Dowben, "McArdle's Disease in an Elderly Woman," *Southern Medical Journal* 78 (1985): 191–193, https://doi.org/10.1097/00007611-198502000-00017.

155. R. Pourmand, D. B. Sanders, and H. M. Corwin, "Late-Onset McArdle's Disease With Unusual Electromyographic Findings," *Archives of Neurology* 40 (1983): 374–377, https://doi.org/10.1001/archneur.1983.04050060074014.

156. J. L. Vives-Corrons, P. Koralkova, J. M. Grau, M. d. M. Mañú Pereira, and R. Van Wijk, "First Description of Phosphofructokinase Deficiency in Spain: Identification of a Novel Homozygous Missense Mutation in the PFKM Gene," *Frontiers in Physiology* 4 (2013): 393, https://doi.org/10.3389/fphys.2013.00393.

157. M. Mori-Yoshimura, K. Aizawa, Y. Oya, et al., "A 78-Year-Old Japanese Male With Late-Onset PHKA1-Associated Distal Myopathy: Case Report and Literature Review," *Neuromuscular Disorders* 32 (2022): 769–773, https://doi.org/10.1016/j.nmd.2022.05.010.

158. N. Preisler, M. C. Orngreen, A. Echaniz-Laguna, et al., "Muscle Phosphorylase Kinase Deficiency," *Neurology* 78 (2012): 265–268, https://doi.org/10.1212/WNL.0b013e31824365f9.

159. C. Hedberg-Oldfors, W. De Ridder, O. Kalev, et al., "Functional Characterization of GYG1 Variants in Two Patients With Myopathy and Glycogenin-1 Deficiency," *Neuromuscular Disorders* 29 (2019): 951–960, https://doi.org/10.1016/j.nmd.2019.10.002.

160. C. Hedberg-Oldfors, A. Mensch, K. Visuttijai, et al., "Polyglucosan Myopathy and Functional Characterization of a Novel GYG1 Mutation," *Acta Neurologica Scandinavica* 137 (2018): 308–315, https://doi.org/10.1111/ane.12865.

161. Z. Argov and R. Navon, "Clinical and Genetic Variations in the Syndrome of Adult GM 2 Gangliodosis Resulting From Hexosaminidase a Deficiency," *Annals of Neurology* 16 (1984): 14–20, https://doi.org/10.1002/ana.410160105.

162. S. Huynh-Moynot, J. C. Moynot, C. Thill, D. Commandeur, M. Ould-Ahmed, and I. Drouillard, "Prolonged Curarisation Following Succinylcholine Injection on Butyrylcholinesterase Deficiency and Potentiated by a Lithium Treatment: A Case Report," *Annales de Biologie Clinique (Paris)* 71 (2013): 485–488, https://doi.org/10.1684/abc.2013.0865.

163. L. A. Burmeister, T. Valdivia, and F. Q. Nuttall, "Adult Hereditary Fructose Intolerance," *Archives of Internal Medicine* 151 (1991): 773–776.

164. D. Dinour, A. Bahn, L. Ganon, et al., "URAT1 Mutations Cause Renal Hypouricemia Type 1 in Iraqi Jews," *Nephrology, Dialysis, Transplantation* 26 (2011): 2175–2181, https://doi.org/10.1093/ndt/gfq722.

165. J. P. Botero, D. Chen, J. A. Majerus, et al., "Hermansky-Pudlak Syndrome Subtype 5 (HPS-5) Novel Mutation in a 65 Year-Old With Oculocutaneous Hypopigmentation and Mild Bleeding Diathesis: The Importance of Recognizing A Subtle Phenotype," *Platelets* 29, no. 1 (2018): 91–94, https://doi.org/10.1080/09537104.2017.1361019.

166. A. L. Ringeisen, L. A. Schimmenti, J. G. White, C. Schoonveld, and C. G. Summers, "Hermansky–Pudlak Syndrome (HPS5) in a Nonagenarian," *Journal of AAPOS* 17 (2013): 334–336, https://doi.org/10.1016/j.jaapos.2013.02.002.

167. K. Takahashi, T. Ishida, G. Ogura, et al., "Diagnostic Usefulness of Bronchoalveolar Lavage in Hermansky–Pudlak Syndrome: A Case With Double Lung Cancers," *Internal Medicine* 43 (2004): 972–976, https://doi.org/10.2169/internalmedicine.43.972.

168. N. M. Jandl, T. Schmidt, T. Rolvien, et al., "Genotype–Phenotype Associations in 72 Adults With Suspected ALPL-Associated Hypophosphatasia," *Calcified Tissue International* 108 (2021): 288–301, https://doi.org/10.1007/s00223-020-00771-7.

169. M. Righetti, J. Wach, R. Desmarchelier, and F. Coury, "Teriparatide Treatment in an Adult Patient With Hypophosphatasia Exposed to Bisphosphonate and Revealed by Bilateral Atypical Fractures," *Joint, Bone, Spine* 85 (2018): 365–367, https://doi.org/10.1016/j.jbspin.2017.12.001.

170. K. w. Wei, K. Xuan, L. Y. Li, et al., "Clinical, Pathological and Genetic Evaluations of Chinese Patients With Autosomal-Dominant Hypophosphatasia," *Archives of Oral Biology* 55 (2010): 1017–1023, https://doi.org/10.1016/j.archoralbio.2010.08.003.

171. P. I. Pillans, P. Berman, and S. J. Saunders, "Cholestatic Jaundice With a Normal Serum Alkaline Phosphatase Level: Another Case of Hypophosphatasia in an Adult," *Gastroenterology* 84 (1983): 175–177.

172. M. Seton and H. Jüppner, "Autosomal Dominant Hypophosphatemic Rickets in an 85-Year-Old Woman: Characterization of Her Disease From Infancy Through Adulthood," *Bone* 52 (2013): 640–643, https://doi.org/10.1016/j.bone.2012.11.012.

173. M. Sasaki, M. Ebata, Z. Tanei, et al., "An Autopsy Case Report of Adult-Onset Krabbe Disease: Comparison With an Infantile-Onset Case," *Pathology International* 72 (2022): 558–565, https://doi.org/10.1111/pin.13275.

174. T. Watanabe, Y. Mashima, K. Kigasawa, A. Mashima, M. Shimura, and A. Hirakata, "Increased Microcirculation on Optic Nerve Head by Laser Speckle Flowgraphy at Early Stage of Leber Hereditary Optic Neuropathy," *Neuroophthalmology* 43 (2019): 411–416, https://doi.org/10.1080/01658107.2018.1526956.

175. A. Hao, T. Hideyama, J. Katsumata, et al., "A Case of Late-Onset Leber's Hereditary Optic Neuropathy With Elevated Serum Lactic Acid and Pyruvic Acid Levels by Cycle Ergometer Exercise," *Neurology and Clinical Neuroscience* 6 (2018): 179–181, https://doi.org/10.1111/ncn3.12219.

176. Y. Shimada and M. Horiguchi, "Leber Hereditary Optic Neuropathy Associated With Bilateral Macular Holes," *Neuroophthalmology* 40 (2016): 125–129, https://doi.org/10.3109/01658107.2016.1148744.

177. A. Viestenz, U. Schlötzer-Schrehardt, C. Hofmann-Rummelt, B. Seitz, and M. Küchle, "Histopathology of Corneal Changes in Lecithin-Cholesterol Acyltransferase Deficiency," *Cornea* 21 (2002): 834–837, https://doi.org/10.1097/00003226-200211000-00022.

178. P. V. S. Souza, T. Bortholin, C. A. C. Teixeira, et al., "Leigh Syndrome Caused by Mitochondrial DNA-Maintenance Defects Revealed by Whole Exome Sequencing," *Mitochondrion* 49 (2019): 25–34, https://doi.org/10.1016/j.mito.2019.06.008.

179. P. McKelvie, B. Infeld, R. Marotta, J. Chin, D. Thorburn, and S. Collins, "Late-Adult Onset Leigh Syndrome," *Journal of Clinical Neuroscience* 19 (2012): 195–202, https://doi.org/10.1016/j.jocn.2011.09.009.

180. K. Sarafoglou, K. Grosse-Redlinger, C. J. Boys, et al., "Lesch-Nyhan Variant Syndrome: Variable Presentation in 3 Affected Family Members," *Archives of Neurology* 67, no. 6 (2010): 761–764, https://doi.org/10.1001/archneurol.2010.116.

181. T. Suzuki, S. Sawada, Y. Ishigaki, et al., "Lipoprotein Lipase Deficiency (R243H) in a Type 2 Diabetes Patient With Multiple Arterial Aneurysms," *Internal Medicine* 55 (2016): 1131–1136, https://doi.org/10.2169/internalmedicine.55.5239.

182. J. M. Hoeg, J. C. Osborne, R. E. Gregg, and H. B. Brewer, "Initial Diagnosis of Lipoprotein Lipase Deficiency in a 75-Year-Old Man," *American Journal of Medicine* 75 (1983): 889–892, https://doi.org/10.1016/0002-9343(83)90423-0.

183. L. Panadés-de Oliveira, J. Montoya, S. Emperador, et al., "A Novel Mutation in the Mitochondrial MT-ND5 Gene in a Family With MELAS. The Relevance of Genetic Analysis on Targeted Tissues," *Mitochondrion* 50 (2020): 14–18, https://doi.org/10.1016/j.mito.2019.10.001.

184. J. L. Pedros o, W. B. V. de Rezen Pinto, O. G. P. Barsottini, and A. S. B. Oliveira, "Should We Investigate Mitochondrial Disorders in

Progressive Adult-Onset Undetermined Ataxias?," *Cerebellum Ataxias* 7 (2020): 13, https://doi.org/10.1186/s40673-020-00122-0.

185. K. Ueki, Y. Wakisaka, K. Nakamura, et al., "Mitochondrial Myopathy, Encephalopathy, Lactic Acidosis, and Stroke-Like Episodes due to m.3243A>G Mutation in a 76-Year-Old Woman," *Journal of the Neurological Sciences* 412 (2020): 116791, https://doi.org/10.1016/j.jns.2020.116791.

186. Y. Yokota, M. Hara, T. Akimoto, et al., "Late-Onset MELAS Syndrome With mtDNA 14453G→A Mutation Masquerading as an Acute Encephalitis: A Case Report," *BMC Neurology* 20 (2020): 247, https://doi.org/10.1186/s12883-020-01818-w.

187. S. Blum, T. Robertson, S. Klingberg, R. D. Henderson, and P. McCombe, "Atypical Clinical Presentations of the A3243G Mutation, Usually Associated With MELAS," *Internal Medicine Journal* 41 (2011): 199–202, https://doi.org/10.1111/j.1445-5994.2010.02379.x.

188. R. A. DeSouza, R. J. Cardenas, T. U. Lindler, F. A. De la Fuente, F. J. Mayorquin, and D. S. Trochtenberg, "Mitochondrial Encephalomyopathy With Lactic Acidosis and Strokelike Episodes (MELAS): A Mitochondrial Disorder Presents as Fibromyalgia," *Southern Medical Journal* 97 (2004): 528–531, https://doi.org/10.1097/00007611-200405000-00023.

189. T. Higashikata, J. Koyama, H. Shimada, et al., "An 80-Year-Old Mitochondrial Disease Patient With A3243G tRNA (Leu(UUR)) Gene Presenting Cardiac Dysfunction as the Main Symptom," *Internal Medicine* 40 (2001): 405–408, https://doi.org/10.2169/internalmedicine.40.405.

190. O. Mori, M. Yamazaki, Y. Ohaki, et al., "Mitochondrial Encephalomyopathy With Lactic Acidosis and Stroke Like Episodes (MELAS) With Prominent Degeneration of the Intestinal Wall and Cactus-Like Cerebellar Pathology," *Acta Neuropathologica* 100 (2000): 712–717, https://doi.org/10.1007/s004010000209.

191. E. M. Stroh, J. M. Winterkorn, A. E. Jalkh, and S. Lessell, "MELAS Syndrome: A Mitochondrially Inherited Disorder," *International Ophthalmology Clinics* 33 (1993): 169–178, https://doi.org/10.1097/00004397-199303320-00016.

192. T. Kawazoe, S. Tobisawa, K. Sugaya, et al., "Myoclonic Epilepsy With Ragged-Red Fibers With Intranuclear Inclusions," *Internal Medicine* 61, no. 4 (2022): 547–552, https://doi.org/10.2169/internalmedicine.7767-21.

193. K. Muthusamy, J. P. Fasolino, E. D. Driver-Dunckley, and R. Dhamija, "Ekbom Syndrome: Ataxia, Myoclonus, and Cervical Lipomas," *Annals of Neurology* 89 (2021): 623–624, https://doi.org/10.1002/ana.25992.

194. S. C. M. Nijmeijer, L. I. van den Born, A. J. A. Kievit, et al., "The Attenuated End of the Phenotypic Spectrum in MPS III: From Late-Onset Stable Cognitive Impairment to a Non-Neuronopathic Phenotype," *Orphanet Journal of Rare Diseases* 14 (2019): 249, https://doi.org/10.1186/s13023-019-1232-0.

195. W. M. A. Verhoeven, R. Csepán, C. L. M. Marcelis, D. J. Lefeber, J. I. M. Egger, and S. Tuinier, "Sanfilippo B in an Elderly Female Psychiatric Patient: A Rare but Relevant Diagnosis in Presenile Dementia," *Acta Psychiatrica Scandinavica* 122 (2010): 162–165, https://doi.org/10.1111/j.1600-0447.2009.01521.x.

196. S. Ebara, T. Kinoshita, Y. Yuzawa, et al., "A Case of Mucopolysaccharidosis IV With Lower Leg Paresis due to Thoraco-Lumbar Kyphoscoliosis," *Journal of Clinical Neuroscience* 10 (2003): 358–361, https://doi.org/10.1016/s0967-5868(03)00033-x.

197. A. Barp, R. Bellance, E. Malfatti, O. Rigal, C. Acquaviva-Bourdain, and P. Laforet, "Late Onset Multiple Acyl-CoA Dehydrogenase Deficiency (MADD) Myopathy Misdiagnosed as Polymyositis," *Journal of Clinical Rheumatology* 26 (2020): e125–e127, https://doi.org/10.1097/RHU.0000000000001000.

198. F. Macchione, L. Salviati, A. Bordugo, et al., "Multiple Acyl-COA Dehydrogenase Deficiency in Elderly Carriers," *Journal of Neurology* 267 (2020): 1414–1419, https://doi.org/10.1007/s00415-020-09729-z.

199. Y. Zheng, Y. Zhao, W. Zhang, Z. Wang, and Y. Yuan, "Late-Onset Multiple Acyl-CoA Dehydrogenase Deficiency Mimicking Myositis in an Elderly Patient: A Case Report," *BMC Neurology* 20 (2020): 436, https://doi.org/10.1186/s12883-020-02010-w.

200. R. V. Bavakunji, J. D. Turner, S. Jujjavarapu, et al., "An Unusual Case of Severe High Anion Gap Metabolic Acidosis," *NDT Plus* 4 (2011): 90–92, https://doi.org/10.1093/ndtplus/sfr009.

201. M. Luigetti, G. Primiano, G. Bisogni, et al., "Progressive Axonal Polyneuropathy in a Mitochondrial Disorder: An Uncommon Association With Familial Amyloid Neuropathy," *Amyloid* 25 (2018): 261–262, https://doi.org/10.1080/13506129.2018.1506919.

202. A. Manini, L. Caporali, M. Meneri, et al., "Case Report: Rare Homozygous RNASEH1 Mutations Associated With Adult-Onset Mitochondrial Encephalomyopathy and Multiple Mitochondrial DNA Deletions," *Frontiers in Genetics* 13 (2022): 906667, https://doi.org/10.3389/fgene.2022.906667.

203. D. B. Ash, "A Novel Mutation in PNPLA2 Leading to Neutral Lipid Storage Disease With Myopathy," *Archives of Neurology* 69 (2012): 1190, https://doi.org/10.1001/archneurol.2011.2600.

204. E. Piva, R. Pajola, G. Binotto, and M. Plebani, "Jordans' Anomaly in a New Neutral Lipid Storage Disease," *American Journal of Hematology* 84 (2009): 254–255, https://doi.org/10.1002/ajh.21186.

205. E. M. Pennisi, S. Missaglia, S. Dimauro, C. Bernardi, H. O. Akman, and D. Tavian, "A Myopathy With Unusual Features Caused by PNPLA2 Gene Mutations," *Muscle & Nerve* 51 (2015): 609–613, https://doi.org/10.1002/mus.24477.

206. M. Gaeta, F. Minutoli, A. Toscano, et al., "Opposed-Phase MR Imaging of Lipid Storage Myopathy in a Case of Chanarin–Dorfman Disease," *Skeletal Radiology* 37 (2008): 1053–1057, https://doi.org/10.1007/s00256-008-0559-8.

207. G. Trendelenburg, "Niemann-Pick Type C Disease in a 68-Year-Old Patient," *Journal of Neurology, Neurosurgery, and Psychiatry* 77 (2006): 997–998, https://doi.org/10.1136/jnnp.2005.086785.

208. K. A. Josephs, J. Y. Matsumoto, and N. M. Lindor, "Heterozygous Niemann-Pick Disease Type C Presenting With Tremor," *Neurology* 63 (2004): 2189–2190, https://doi.org/10.1212/01.wnl.0000145710.25588.2f.

209. M. Wu, R. Ceponiene, E. Bayram, and I. Litvan, "Two Patients With Niemann Pick Disease Type C Diagnosed in the Seventh Decade of Life," *Movement Disorders Clinical Practice* 7 (2020): 961–964, https://doi.org/10.1002/mdc3.13085.

210. N. Kumar, P. Rizek, Y. Mohammad, and J. M. Pearls, "Oysters: Niemann-Pick Disease Type C in a 65-Year-Old Patient," *Neurology* 87, no. 8 (2016): e79–e81, https://doi.org/10.1212/WNL.0000000000003011.

211. J. Marquetand, P. Freisinger, T. Lindig, S. Euler, M. Gasser, and D. Overkamp, "Ammonia and Coma—A Case Report of Late Onset Hemizygous Ornithine Carbamyltransferase Deficiency in 68-Year-Old Female," *BMC Neurology* 20 (2020): 118, https://doi.org/10.1186/s12883-020-01700-9.

212. K. Daijo, T. Kawaoka, T. Nakahara, et al., "Late-Onset Ornithine Transcarbamylase Deficiency Associated With Hyperammonemia," *Clinical Journal of Gastroenterology* 10 (2017): 383–387, https://doi.org/10.1007/s12328-017-0753-0.

213. G. P. Bijvoet, C. J. M. van der Sijs-Bos, J. P. M. Wielders, and O. A. Groot, "Fatal Hyperammonaemia due to Late-Onset Ornithine Transcarbamylase Deficiency," *Netherlands Journal of Medicine* 74 (2016): 36–39.

214. C. Cavicchi, M. A. Donati, R. Parini, et al., "Sudden Unexpected Fatal Encephalopathy in Adults With *OTC* Gene Mutations-Clues for Early Diagnosis and Timely Treatment," *Orphanet Journal of Rare Diseases* 9 (2014): 105, https://doi.org/10.1186/s13023-014-0105-9.

215. A. Cheldi, D. Ronchi, A. Bordoni, et al., "POLG1 Mutations and Stroke Like Episodes: A Distinct Clinical Entity Rather Than an Atypical MELAS Syndrome," *BMC Neurology* 13 (2013): 8, https://doi.org/10.1186/1471-2377-13-8.

216. D. Lehmann Urban, L. Motlagh Scholle, K. Alt, A. C. Ludolph, and A. Rosenbohm, "Camptocormia as a Novel Phenotype in a Heterozygous *POLG2* Mutation," *Diagnostics (Basel)* 10 (2020): 68, https://doi.org/10.3390/diagnostics10020068.

217. M. Lang-Orsini and P. Gonzalez-Perez, "Neuropathic Pain as Main Manifestation of *POLG*-Related Disease: A Case Report," *Frontiers in Neurology* 13 (2022): 846110, https://doi.org/10.3389/fneur.2022.846110.

218. J. Johal, R. Castro Apolo, M. W. Johnson, et al., "Adult Polyglucosan Body Disease: An Acute Presentation Leading to Unmasking of This Rare Disorder," *Hospital Practice (1995)* 50, no. 3 (2022): 244–250, https://doi.org/10.1080/21548331.2021.1874182.

219. G. Tasca, F. Fattori, M. Monforte, et al., "Start Codon Mutation of GYG1 Causing Late-Onset Polyglucosan Body Myopathy With Nemaline Rods," *Journal of Neurology* 263 (2016): 2133–2135, https://doi.org/10.1007/s00415-016-8268-z.

220. S. Sampaolo, T. Esposito, F. Gianfrancesco, et al., "A Novel GBE1 Mutation and Features of Polyglucosan Bodies Autophagy in Adult Polyglucosan Body Disease," *Neuromuscular Disorders* 25 (2015): 247–252, https://doi.org/10.1016/j.nmd.2014.11.006.

221. M. Desikan, R. S. Scalco, A. Manole, et al., "GYG1 Causing Progressive Limb Girdle Myopathy With Onset During Teenage Years (Polyglucosan Body Myopathy 2)," *Neuromuscular Disorders* 28 (2018): 346–349, https://doi.org/10.1016/j.nmd.2018.01.002.

222. F. H. AlGahtani, R. Stuckey, and F. S. Alqahtany, "Secondary Hemosiderosis Presented by Porphyria Cutanea Tarda in a Kidney Dialysis Patient: A Case Report," *SAGE Open Medical Case Reports* 8 (2020): 2050313X20907815, https://doi.org/10.1177/2050313X20907815.

223. D. Calista, "Zosteriform Persistent Acantholytic Dermatosis and Porphyria Cutanea Tarda," *JEADV* 5 (1995): 181–184, https://doi.org/10.1111/j.1468-3083.1995.tb00542.x.

224. E. Richard, J. M. Blouin, J. Harambat, et al., "Late Diagnosis of Primary Hyperoxaluria Type III," *Annals of Clinical Biochemistry* 54 (2017): 406–411, https://doi.org/10.1177/0004563216677101.

225. J. J. Martin, A. Vercruyssen, T. de Barsy, and C. Ceuterick, "Muscle Carnitine Deficiency in Old Age," *Clinical Neurology and Neurosurgery* 87 (1985): 275–281, https://doi.org/10.1016/0303-8467(85)90135-0.

226. M. Li, A. Al-Sarraf, G. Sinclair, and J. Frohlich, "Fish Odour Syndrome," *CMAJ* 183, no. 8 (2011): 929–931, https://doi.org/10.1503/cmaj.100642.

227. J. Finsterer, I. Oberman, and A. Reitner, "Respiratory Chain Complex-I Defect Mimicking Myasthenia," *Metabolic Brain Disease* 17 (2002): 41–46, https://doi.org/10.1023/a:1014052330663.

228. L. García Morales, R. G. Mustelier Bécquer, L. Pérez Joglar, and T. Zaldívar Vaillant, "Sandhoff Disease in the Elderly: A Case Study," *Amyotroph Lateral Scler Frontotemporal Degener* 23 (2022): 137–138, https://doi.org/10.1080/21678421.2021.1892146.

229. R. García Castro, A. M. González Pérez, M. C. Román Curto, et al., "A New Case of Schindler Disease," *EJCRIM* 6 (2019): 1, https://doi.org/10.12890/2019_001269.

230. T. Fasano, P. Zanoni, C. Rabacchi, et al., "Novel Mutations of ABCA1 Transporter in Patients With Tangier Disease and Familial HDL Deficiency," *Molecular Genetics and Metabolism* 107 (2012): 534–541, https://doi.org/10.1016/j.ymgme.2012.08.005.

231. T. A. Pressly, J. O. Franklin, M. A. Alpert, G. P. Reams, and L. M. Taylor, "Cardiac Valvular Involvement in Tangier Disease," *American Heart Journal* 113 (1987): 200–202, https://doi.org/10.1016/0002-8703(87)90032-9.

232. A. Marbini, F. Gemignani, G. Ferrarini, et al., "Tangier Disease. A Case With Sensorimotor Distal Polyneuropathy and Lipid Accumulation in Striated Muscle and Vasa Nervorum," *Acta Neuropathologica* 67 (1985): 121–127, https://doi.org/10.1007/BF00688132.

233. J. K. Yao, P. N. Herbert, D. S. Fredrickson, et al., "Biochemical Studies in a Patient With a Tangier Syndrome," *Journal of Neuropathology and Experimental Neurology* 37 (1978): 138–154, https://doi.org/10.1097/00005072-197803000-00003.

234. M. G. Mavilia, A. Sharma, and F. Forouhar, "Metastatic Cholangiocarcinoma in a Patient With Undiagnosed Wilson Disease," *Annals of Hepatology* 18 (2019): 929–931.

235. C. Gasca-Salas, A. Alonso, R. González-Redondo, and J. A. Obeso, "Coexisting Parkinson's and Wilson's Disease: Chance or Connection?," *Canadian Journal of Neurological Sciences* 44 (2017): 215–218, https://doi.org/10.1017/cjn.2016.327.

236. L. J. Lin, D. X. Wang, N. N. Ding, Y. Lin, Y. Jin, and C. Q. Zheng, "Comprehensive Analysis on Clinical Features of Wilson's Disease: An Experience Over 28 Years With 133 Cases," *Neurological Research* 36 (2014): 157–163, https://doi.org/10.1179/1743132813Y.0000000262.

237. A. Ala, J. Borjigin, A. Rochwarger, and M. Schilsky, "Wilson Disease in Septuagenarian Siblings," *Hepatology* 41 (2005): 668–670, https://doi.org/10.1002/hep.20601.

238. T. Kumagi, N. Horiike, M. Abe, et al., "Small Hepatocellular Carcinoma Associated With Wilson's Disease," *Internal Medicine* 44 (2005): 439–443, https://doi.org/10.2169/internalmedicine.44.439.

239. M. Badii, H. Wong, U. P. Steinbrecher, and H. J. Freeman, "Wilson's Disease in an Elderly Patient," *Canadian Journal of Gastroenterology* 9 (1995): 78–80, https://doi.org/10.1155/1995/352692.

240. K. Ogaki, S. Koga, N. Aoki, et al., "Adult-Onset Cerebello-Brainstem Dominant Form of X-Linked Adrenoleukodystrophy Presenting as Multiple System Atrophy: Case Report and Literature Review," *Neuropathology* 36 (2016): 64–76, https://doi.org/10.1111/neup.12230.

241. J. Finsterer, S. Lässer, and E. Stöphasius, "Dementia From the *ABCD1* Mutation c.1415-1416delAG in a Female Carrier," *Gene* 530 (2013): 155–157, https://doi.org/10.1016/j.gene.2013.07.073.

242. L. Tremolizzo, M. Patassini, G. Uziel, et al., "Granny Trips Down: Is She Carrying the Big Bad Wolf?," *Neurological Sciences* 34 (2013): 2077–2079, https://doi.org/10.1007/s10072-012-1108-8.

243. A. K. Guettsches, A. Kuechler, A. Gal, W. Schmitz, M. Tegenthoff, and M. Vorgerd, "Female Carriers of X-Chromosomal Adrenoleukodystrophy: A Major Differential Diagnosis in Progressive Myelopathy," *Journal of Neurology* 257 (2010): 1394–1395, https://doi.org/10.1007/s00415-010-5505-8.

244. J. Jaros, A. M. Sergeyenko, and M. B. Bain, "Coalescing Hyperkeratotic Plaques and Papules," *Cutis* 102 (2018): 402 414, 415.

245. L. Gonzalez-Huerta, J. Mendiola-Jimenez, M. Del Moral-Stevenel, M. Rivera-Vega, and S. Cuevas-Covarrubias, "Atypical X-Linked Ichthyosis in a Patient With a Large Deletion Involving the Steroid Sulfatase (STS) Gene," *International Journal of Dermatology* 48 (2009): 142–144, https://doi.org/10.1111/j.1365-4632.2009.03996.x.

246. Y. Fujiwara, Y. Kawakami, Y. Shinohara, and K. Ichida, "A Case of Hereditary Xanthinuria Type 1 Accompanied by Bilateral Renal Calculi," *Internal Medicine* 51 (2012): 1879–1884, https://doi.org/10.2169/internalmedicine.51.6891.

247. A. Jurecka, B. Stiburkova, J. Krijt, W. Gradowska, and A. Tylki-Szymanska, "Xanthine Dehydrogenase Deficiency With Novel Sequence Variations Presenting as Rheumatoid Arthritis in a 78-Year-Old

Patient," *Journal of Inherited Metabolic Disease* 33 (2010): 21–24, https://doi.org/10.1007/s10545-009-9011-z.

248. C. Sadasivan, J. T. Y. Chow, B. Sheng, et al., "Screening for Fabry Disease in Patients With Unexplained Left Ventricular Hypertrophy," *PLoS One* 15 (2020): e0239675, https://doi.org/10.1371/journal.pone.0239675.

249. A. Moonen, S. Lal, J. Ingles, L. Yeates, C. Semsarian, and R. Puranik, "Prevalence of Anderson-Fabry Disease in a Cohort With Unexplained Late Gadolinium Enhancement on Cardiac MRI," *International Journal of Cardiology* 304 (2020): 122–124, https://doi.org/10.1016/j.ijcard.2019.12.059.

250. S. A. Alhemyadi, M. Elawad, K. Fourtounas, et al., "Screening for Fabry Disease Among 619 Hemodialysis Patients in Saudi Arabia," *Saudi Medical Journal* 41 (2020): 813–818, https://doi.org/10.15537/smj.2020.8.25184.

251. Â. V. Chaves-Markman, M. Markman, E. B. Calado, et al., "GLA Gene Mutation in Hypertrophic Cardiomyopathy With a New Variant Description: Is It Fabry's Disease?," *Arquivos Brasileiros de Cardiologia* 113 (2019): 77–84, https://doi.org/10.5935/abc.20190112.

252. K. Koulousios, K. Stylianou, P. Pateinakis, et al., "Fabry Disease due to D313Y and Novel *GLA* Mutations," *BMJ Open* 7 (2017): e017098, https://doi.org/10.1136/bmjopen-2017-017098.

253. K. Nagamatsu, Y. Sekijima, K. Nakamura, et al., "Prevalence of Fabry Disease and GLA c.196G>C Variant in Japanese Stroke Patients," *Journal of Human Genetics* 62 (2017): 665–670, https://doi.org/10.1038/jhg.2017.31.

254. T. Kubo, Y. Ochi, Y. Baba, et al., "Prevalence and Clinical Features of Fabry Disease in Japanese Male Patients With Diagnosis of Hypertrophic Cardiomyopathy," *Journal of Cardiology* 69 (2017): 302–307, https://doi.org/10.1016/j.jjcc.2016.05.014.

255. K. Turkmen, A. Guclu, G. Sahin, et al., "The Prevalence of Fabry Disease in Patients With Chronic Kidney Disease in Turkey: The TURKFAB Study," *Kidney & Blood Pressure Research* 41 (2016): 1016–1024, https://doi.org/10.1159/000452605.

256. O. Saito, E. Kusano, T. Akimoto, et al., "Prevalence of Fabry Disease in Dialysis Patients: Japan Fabry Disease Screening Study (J-FAST)," *Clinical and Experimental Nephrology* 20 (2016): 284–293, https://doi.org/10.1007/s10157-015-1146-7.

257. C. A. B. Silva, F. C. Barreto, M. A. dos Reis, J. A. Moura Junior, and C. M. S. Cruz, "Targeted Screening of Fabry Disease in Male Hemodialysis Patients in Brazil Highlights Importance of Family Screening," *Nephron* 134 (2016): 221–230, https://doi.org/10.1159/000448740.

258. K. Mawatari, H. Yasukawa, T. Oba, et al., "Screening for Fabry Disease in Patients With Left Ventricular Hypertrophy," *International Journal of Cardiology* 167 (2013): 1059–1061, https://doi.org/10.1016/j.ijcard.2012.10.076.

259. W. Terryn, G. Deschoenmakere, J. De Keyser, et al., "Prevalence of Fabry Disease in a Predominantly Hypertensive Population With Left Ventricular Hypertrophy," *International Journal of Cardiology* 167 (2013): 2555–2560, https://doi.org/10.1016/j.ijcard.2012.06.069.

260. P. Elliott, R. Baker, F. Pasquale, et al., "Prevalence of Anderson-Fabry Disease in Patients With Hypertrophic Cardiomyopathy: The European Anderson-Fabry Disease Survey," *Heart* 97 (2011): 1957–1960, https://doi.org/10.1136/heartjnl-2011-300364.

261. P. Gaspar, J. Herrera, D. Rodrigues, et al., "Frequency of Fabry Disease in Male and Female Haemodialysis Patients in Spain," *BMC Medical Genetics* 11 (2010): 19, https://doi.org/10.1186/1471-2350-11-19.

262. A. Taillandier, C. Domingues, C. De Cazanove, et al., "Molecular Diagnosis of Hypophosphatasia and Differential Diagnosis by Targeted Next Generation Sequencing," *Molecular Genetics and Metabolism* 116 (2015): 215–220, https://doi.org/10.1016/j.ymgme.2015.09.010.

263. M. Confalonieri, M. Vitacca, R. Scala, et al., "Is Early Detection of Late-Onset Pompe Disease a Pneumologist's Affair? A Lesson From an Italian Screening Study," *Orphanet Journal of Rare Diseases* 14, no. 1 (2019): 62, https://doi.org/10.1186/s13023-019-1037-1.

264. E. Gutiérrez-Rivas, J. Bautista, J. J. Vílchez, et al., "Targeted Screening for the Detection of Pompe Disease in Patients With Unclassified Limb-Girdle Muscular Dystrophy or Asymptomatic hyperCKemia Using Dried Blood: A Spanish Cohort," *Neuromuscular Disorders* 25 (2015): 548–553, https://doi.org/10.1016/j.nmd.2015.04.008.

265. J. Müller vom Hagen, K. N. Karle, R. Schüle, I. Krägeloh-Mann, and L. Schöls, "Leukodystrophies Underlying Cryptic Spastic Paraparesis: Frequency and Phenotype in 76 Patients," *European Journal of Neurology* 21 (2014): 983–988, https://doi.org/10.1111/ene.12423.

266. F. Faye, C. Crocione, R. Anido de Peña, et al., "Time to Diagnosis and Determinants of Diagnostic Delays of People Living With a Rare Disease: Results of a Rare Barometer Retrospective Patient Survey," *European Journal of Human Genetics* 32 (2024): 1116–1126, https://doi.org/10.1038/s41431-024-01604-z.

267. K. Valtola, M. Hedman, I. Kantola, et al., "Late-Onset and Classic Phenotypes of Fabry Disease in Males With the *GLA*-Thr410Ala Mutation," *Open Heart* 10 (2023): e002251, https://doi.org/10.1136/openhrt-2023-002251.

268. E. Monda, M. Rubino, E. Riccio, et al., "Clinical Manifestation of Patients With Fabry Disease and R356W *GLA* Variant," *International Journal of Cardiology* 392 (2023): 131295, https://doi.org/10.1016/j.ijcard.2023.131295.

269. G. Bernardini, D. Braconi, A. Zatkova, et al., "Alkaptonuria," *Nature Reviews Disease Primers* 10, no. 1 (2024): 16, https://doi.org/10.1038/s41572-024-00498-x.

270. A. Loret, C. Jacob, S. Mammou, et al., "Joint Manifestations Revealing Inborn Metabolic Diseases in Adults: A Narrative Review," *Orphanet Journal of Rare Diseases* 18 (2023): 239, https://doi.org/10.1186/s13023-023-02810-6.

271. K. R. Spears, F. Rossignol, M. B. Perry, et al., "Patient-Reported Outcomes and Functional Assessments of Patients With Alkaptonuria in a 3-Year Nitisinone Treatment Trial," *Molecular Genetics and Metabolism* 143 (2024): 108562, https://doi.org/10.1016/j.ymgme.2024.108562.

272. G. Salen and R. D. Steiner, "Epidemiology, Diagnosis, and Treatment of Cerebrotendinous Xanthomatosis (CTX)," *Journal of Inherited Metabolic Disease* 40 (2017): 771–781, https://doi.org/10.1007/s10545-017-0093-8.

273. J. Beall, "Predatory Publishers Are Corrupting Open Access," *Nature* 489 (2012): 179, https://doi.org/10.1038/489179a.

274. A. Sechi, E. Fabbro, M. Langeveld, et al., "Education and Training in Adult Metabolic Medicine: Results of an International Survey," *Journal of Inherited Metabolic Disease* 49 (2019): 63–69, https://doi.org/10.1002/jmd2.12044.

275. S. Sirrs, E. Fabbro, A. Sechi, and SSIEM Adult Metabolic Medicine Training Competencies Working Group, "Training Competencies in Adult Metabolic Medicine: A Survey of Working Adult Metabolic Medicine Physicians," *Journal of Inherited Metabolic Disease* 63 (2022): 468–474, https://doi.org/10.1002/jmd2.12312.

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