Subtitles and transcriptions
Subtitles and transcriptions are available for selected materials for purpose of helping users understand the contents of the educational sessions.
Uncertain words have been indicated with ?? before and after the part. Parts that could not be understood at all have been indicated as [Audio Not Clear].

Every effort has been made to faithfully reproduce the audio of the sessions as recorded. However, no responsibility is accepted for mistakes or omissions. ESO does not endorse any opinions expressed in the presentations.

Lung cancer digital diagnosis and stratification using AI tools

Dr Fukuoka: Thank you for inviting me for this talk. My name is Junya Fukuoka, I'm a practising pathologist in Japan. My title today is Lung Cancer Digital Diagnosis and Stratification using AI Tools. Here's some disclosure. See what I disclose. Okay. My talk is mostly case based. So, in this way, I want to share some programmes of the pathology with you. And I will show you how digital and AI would solve the issues. First case is a case from 68-year-old man with smoking history. He was found to have 1.2 cm nodule in the left upper lung. The nodule grows slowly, and trans bronchial biopsy showed non-diagnostic materials. The surgeon performed a wedge resection on this. So, here's the morphology. Well, although, I don't use microscope for years, so, this is a video I took through the microscope. I think this is an image that will be familiar to most of the people listening to this talk. Let's just start. So, by looking at this, how do you think, how do you reach the diagnosis? Yeah, so those are out of focus moment and change of the light from at the time of rotations, very dark to the strong light. Sometimes, it irritates my eyes. But the morphology is good, and the goodness of the microscope is- we can move the Z-stack to see the depth of the tissue. So, looking at morphology, what do think? Okay, now, about a minute of observation, you may reach to this type of differential diagnosis. So, which one do you prefer as a final diagnosis? Rethink about it. But there are several issues to solve. To really pick up the one right diagnosis for this one. So, I'll show you how we do by using the digital pathology. So, what are changes of digital and AI diagnosis for this case? So, here, what is good about digital pathology is providing a very nice low magnification view. We can make an annotation for the margins and the pleural area to look and also, we observe the morphology, find the [Audio Not Clear] one, just make annotation, okay, there is a double set, and we can just annotate all the mitosis in a two-millimetre square area. And we make the stas, we mark the stas to highlight. And by looking at the immuno staining and a look at the split of the stas inside the air spaces and this particular case, shows a pretty close stas to the margin. So, here's a margin. How much distance we have is less than 0.5-millimeter, which is pretty bad for this patient. Also, to know about the aggressiveness and also to reach the criteria of the small cell, we need to have the score of the KI 67. So, we use those AI tool to predict the mitosis, the KI-67 positivity. And for this one particular case shows 58% of the KI-67 positive cells. So, then the possibility diagnosis of this particular case is a small cell carcinoma with histological features of carcinoid, which is suggested by the new WHO. This is showing the features, morphological features of the carcinoid, although the mitosis is in a way too high to stay with a diagnosis of carcinoid. And Ki-67 is also very high. This may fit to a NET G3 in pancreas and

often shows the lack of the TP53 and RB1 mutations. So, maybe, showing a different prognosis and also, the effect to the chemotherapy, but the current classification, we have to stay with the diagnosis of this one. So, second case is a case like this, 69-years-old woman left upper lobe, three-centimetre mass growing in endobronchial manner. And there's no lymph node metastasis, no other critical histories. If you have a smart phone, you can just capture this QR code, then you see the exact same images and slides in your smartphone. If you can click, just copy, and paste this address, same thing, you can look at the exact the same case on your computer. I will share the case with you. Here those tumours are mostly endobronchial, showing a little bit of yellowish tumour. And if you look at the morphology, this is showing a blue cell neoplasm, very high NC ratio. There's no necrosis, mitosis is not very, very high. It's very difficult to find out mitosis by quick observations. And there is a little bit of organoid structure indicating about possible neuroendocrine features. And TTF1 is positive, very diffusely. I think it's about 70%, but at the same time P40 is also diffusely positive, ncam CD 56 shows DPS positive suggesting neuroendocrine markers. And Ki-67 for this particular case is not that high as a small cell carcinoma. And amount of the Ki-67 as an average is, okay, wait a minute. I'm just adjusting. That's too much, adjusting the conditions, and okay, this looks okay. I'm suggesting that the percentage is 15%. So, my diagnosis is like this: small cell round cell, small round cell tumour, and [Audio Not Clear] difficult to classify. And I felt like this needs a consultation. I still don't know what the accurate diagnosis of this one is, if you have some very good suggestion to me, please find out my email and send me an email and let me and noticing me about the diagnosis. So, I took about a set of other markers, I worried about NUT carcinoma, but NUT was negative, and also, as my S100-, which is negative, melanoma was ruled out, and several different things. So, this type of case, we need multiple consultations, but if you really wanted to do a consultation for the multiple experts what do we need to prepare is about, let's say, ask technician for 30 unstained slides? Maybe more than that? And send slides and wait for the consultation report to come. And we lose the tissue for the molecular test as well. But if we do digitally, what would we do through the digital? So, I'll show you how we do for the digital consultations. Okay, we'll create a new case. For this particular case, we set an ECP consultation case and put here the patient's name, or this is just the fake name, but then, but put here the age, and her occupations, and we need to add a pre-made images or slides for this consultation portal. We say that the number, name of the case, and we embed the link of the images and then address some pathologies, particularly for this case, we'll just address myself, and send this around. Then the email will be sent to the consultant. In this way we could get the consultation report in a same day or next day. So, it's very quick. You don't need to ask technician to prepare the slides either. Case 3 is a tumour from the 62-year-old man who smoked quite a bit. And as you can see, left lower lobe mass with a pleural effusion was detected, with a lymph node metastasis. So, his clinical stage was already a stage 4B and there was a massive lymph node metastasis. So, they took data tissue from the lymph node through the TBNA. So, I'll show the morphology. Here's the digital slides, please take a look, the diagnosis is quite easy, it's an adenocarcinoma. And the issue is that we need to submit this tissue for the molecule work and [Audio Not Clear] submit this one to oncomine test. Okay, we see quite a bit of the nuclear in the several red blood cells. And also, are some tissues of the bronchial cells along with the tumour cells. So, how much is the tumour percentage for this particular case? So, what we do is that we do all of those calculations using AI. So, as I said, all the case diagnosis for the biopsy was done through the digitally. So, when we look at a digital case like this one, we annotate the area of the interest and ask our team of the AI analysis to elaborate this case. And next day, morning, we'll look at those cases by several pathologists and evaluate the AI data if needed. We modify the data and report. And if it's... to submit the tissue to adequate test. Speaking of which we have nearly 10 group hospitals in our group, which is spread through a whole geographic area of the Japan, from the north to the south, more than 1,000 kilometres away. So, how we do is just we download all the cases and at the Nagasaki University. So, centralise the AI analysis of the whole satellite hospitals. So, by doing so, this is the image analysis. This is a repetition that we're looking at these cases and we confirm, okay, the pathology. And all the pathologists will predict their impressions and how much the percentage of tumour cells before looking at the AI model analysis. So, now, at the day, we evaluate how good the AI model for this detection is, sometimes it's a poor program for the quality, but this particular case, the model predicted the

cancer cells very well and nuclear as well. By looking at the number, whole total small, small cells as near the 8,000 cells. So, total nuclear count was 32 cells and tumour cells. Nuclear count was nearly 8,000. You know as giving us here the results of the tumour's cell percentage were 24.89%. So, this is a little bit less than the 30% which was a requirement for the oncomine. We debated for this particular case. But to be on a safer side, we selected for the alternative, why submitting cases to several different molecular tests, rather than submitting this to the multiplex tests, as oncomine. As you can probably here see, we have quite a difficulty to predict tumour cell counts. This is the figure showing how different the pathologist first impression, and after the input of AI, we tend to over-look at the tumour percentage when we have quite a few other experiences. But after several cases of experience, we adjust ourselves to ground truth but still make a mess. There are difficult to predict very accurate numbers, and then we evaluated accuracy comparing the pathologist variation, as sometimes the consensus, and AI+, pathologist's variations. And those are the best and across to the ground truth. So, this case was submitted the EGFR for Cobas test and found out here about Ex19 deletions. And patient got here Osimertinib. And as you can see, that then the tumour disappeared and do not come back for the 2.5 years. Case 4 is the case from a 74-year-old woman who has right middle lobe, 13-millimeter, plus lymph node metastases. And the critical stage was stage 3A. And they did this chemotherapy and radiation before the lobectomy, and the biopsy was proved to have a TTF1/Napsin A+ and proved to have adenocarcinoma of the lung. I'll show you the morphology. This is the morphology of the case. So, we here have about quite a scar, probably due to the effect of the treatment, but we still have those raptures over the tumours. So, the issue is that, is this. How good the effect of the treatment was? So, we have to tell, this is obviously not a CPR, but is this MPR or not? Is the issue. So, MPR, major pathology response, is the one thing we have to make a judgement for this type of cancer, who received a neoadjuvant treatment. Tumour bed and also recreated and among the tumour bed, we have to score the viable tumour, along with the area of necrosis. This particular case doesn't have an area of necrosis. We still have to account how much the area of viable tumour, and all the tumour bed. So, how do we do? Is that, okay, we observed those tissues, and we will just saturate the area or the tumour bed as this is and then, after getting the whole area of the tumour bed, would evaluate the segmentation of the AI, which shows pretty good work. It's not the best that we had predict, this is fairly accurate. And then get the number of the tumour bed area, was like this number, and the total viable tumour was less than 10%, is actually 7.4% by this model. So, we are comfortable to make a judgment that this fits to the diagnosis of MPR positive. So, this is a summary of my talk. I just, you know, shared those benefits of the digital pathology AI by showing the four cases; these are not very special cases. These are several recent cases. I just picked up them for the today's talk. Okay, I'll make a summary of my talk as these are the digital sign out enables to scale size of the tumour, distance to the margin, mitosis count and, et cetera, very easily; and annotations make diagnostic process faster and also, objective. And image analysis for IHC is easy and more objective, including Ki-67 count and consultation is quite easy without effort of the pathology technicians. And TAT is excellent. And AI aided diagnosis offer more objective numbers for tumour cell count and MPR judge than pathologist alone. So, by that, I want to thank you for paying attention and happy to receive questions. Thank you.