American Brain Tumor Association Webinar

Molecular Testing: How it’s Improving Brain Tumor Diagnosis

>>The American brain tumors are seeing is pleased to welcome you back to the webinar series and the webinar will discuss more -- Molecular Testing and how it’s improving brain tumor diagnosis. My name is Alex in the research grant manager and then delighted to introduce Keith Ligon. Dr. Ligon is at Harvard Medical School and Brigham and Women's Hospital and Children's Hospital in Boston. Thank you for joining us and now you may begin your presentation.

>> Thank you. I want to thank everyone for joining today. I am going to speak today about Molecular Testing and the exciting changes and developments that have happened over the years that have worked towards improving brain tumor diagnosis. This is going to be a complementary talk where Dr. Patrick Lynn will give a talk on the implications of the testing or the therapies in and things like that later on. I do want to encourage that if people have any questions, and if they would like to reach out, feel free to e-mail or call after the webinar if you have any questions or require any other applications. I would like to point out, I am a neural pathologist who practices both in adult and pediatric brain tumors. The concepts and we will talk about today would apply to adult or pediatrics and I will highlight some of each test and how they might apply to each but the testing and approach will be applicable to any type of brain tumor patient.
The first thing I would like to discuss is how pathologist diagnose or were to generate information about brain tumors for patients and how is that information use. This is a process that pathologist undergo every day and we work hard to generate diagnoses that are reliable that don't change from place to place in opinion to opinion but it is an organic process and involves multiple steps of information, data and impressions from both pathology and treating physicians. My diagram is a thought process of what a pathologist goes through in the first approaching a brain tumor or diagnosis in the first is going to assign the tumor a tumor class. This is the actual diagnosis of a brain tumor. Something like a term of Leland I stone, -- glioblastoma. You really need to know the diagnosis in order to accurately decide what type of grade the tumor would have and when we mean by grade, is it -- it is somewhat related -- related to the biology and how we expected to behave. And as far as doesn't look like a better or worse variance of that particular tumor will talk more about how we might do that with molecular test later on. Each of these assignments, have strong implications and impact and basically determine the treatment that an oncologist or radiation oncologist or surgeon would expect their treatment and how and what they want to apply to the patient. It really is dictated to a large degree of the process. The response that is expected to the treatment, it's also determined by what we know of the tumor with class and grade and then the prognosis of how we expect the patient to do in the long run and determined by these types of information.

Listed below are two ways which pathologist list data in order to make these predictions and help patients and their treatment team and that first most important is still in today, what we call histopathology and this is really the cornerstone of diagnosis for all types of pathology. It involves a microscope and it is a tool that we have been using since the 1600s in order to look at tumors and diagnose patients and no more about them. It is a very old technology and a lot of concern or discussion and debate whether molecular testing can replace and sometimes it might be a relevant discussion but right now it is an efficient tool. You come to very good conclusions about it. We have consensus statements and rules that we fall in order to diagnose tumors but today we will focus on how it improved greatly by adding molecular testing to the mix and there are several tools we will go through and discuss. That are used with testing and one is a chemistry IHC and one is a can cytogenetics and knees test maybe heard of as FISH or ArrayCGH and we will talk about sequencing technologies. This is also generally based on DNA. In you may have heard terms of Excel sequencing -- Exome and whole genome and we will go into great detail on that because it is not used quite as much for clinical care at this point.
How to regenerate or obtain all this data, the process of generation of the data requires an integrated approach to the diagnosis. Also involved in research and what I diagram is an example of the type of process that goes on behind the scenes. In order to generate all types of information for patient care, the first up is usually critical with -- which is a consenting a patient and discussion about what might happen to their sample after it has been removed. If there is a biopsy or recession done. Brain tumor patients, we want to learn and work with patients to learn as much is we can about their tumor as well as help future patients through research studies and consenting is research but also they can help with clinical trials later down the line. That is a critical state -- stop to do the most we can from patient samples. Surgeons are critical component with removing the tumor and treating patients and we work with pathology to coordinate with them in order to generate and capture the tissue for diagnosis and properly handle it. There is often many different avenues or spinning out that tumors are studied for clinical care and research. FFPE Is tissue that is generated with the microscopic diagnosis and that is routinely done for essentially every patient. Frozen tissue is important in today's age and in the past it might not have been as important but there is an increasing awareness that many trials and studies do need to use frozen tissue and oftentimes centers are attempting to freeze samples and this is important for patients as well. And to store them in the event there is a need with specialist technology. The next step is fresh allocation, you see below in the box, fresh tissue can be used to generate living tissue bank or patient derived models and these are avatars of the patient tumor. We will not talk about this too much today. It is an exciting area whereby fresh tissue is kept alive and -- in either cultures or mice and try to have another portion of the tumor that can be studied outside of your body and do so quickly.

All of these can feed into DNA, protein analysis and on the right we have tools that we will talk about today of the different tests and specifically that might be applied to do this. All this information is work and quite a bit of data that is generated and now the task is integrating and making the data useful.
Going back to the first age of the process where the tumor comes out and how are you going to decide the diagnosis and using any of these tools, how will that and what are the rules by which a pathologist might do, this is the WHO classification of tumors and this is a textbook which every rural pathologist use and it way rules that we followed to standardize across hospitals a consensus approach to classification. So the classification will be [Indiscernible]. This [Indiscernible] and it does discuss and starting to evolve into something that will incorporate molecular diagnosis as well. Really it is a world diagnosis approach and this is something that is improved brain tumor diagnostics synthesis section. Back in 2007 is a large group of pathologist and scientist in oncologist and the last edition have 73 different experts and authors creating it so it does represent a group with the most important things to look for in diagnosis. It is a challenge, if you look at the book you'll notice there's more than 100 you'll notice there's more than 128 brain tumor types discussed in this book and a list of them here. Really there is new types of entities added every time and this number gets bigger and not smaller and so it really is test to come up with diagnosis treatment for this mini tumors and all located within the brain or Mac not really counting metastatic tumors that might come from other parts of the body.

What is driving the incorporation or addition diagnosis, technology is a key driver with pathology and diagnostics. It moves fairly rapidly and the human genome project which began in 1990 from around 2003 was when the projects were ongoing and the genomes were first sequenced. The next question profiling 1992, not too long ago was first invented and who genome approaches came along and personalized genomics and this is around the 2000 that people were thinking about this. And theoretical level data that has been generated with all these types of tools for personalization or precision medicine is really staggering rainout and quite unprecedented. It's moving fairly quickly and really why is it moving quickly as well, because the clinical care of ring tumor patients is changing in cancer in general and patients are increasingly responding to therapy at least the agents that we are using they are starting to have impact on patient outcome. The greater implications are implied in the diagnosis class in grade that we give or Mac a difference between -- that we give.
The correlations and personalized medicine that are not needed from the data to try and predict how patients will respond to treatment is escalating. You trails and drugs as you probably are familiar with our common place. There's many more drugs than the used to be and a drug generally in today's world are designed to act against specific molecular targets. Diagnosis is something that guides something who might get the drugs and treatments because it is the way in which we identify what patients might respond. Increased pathologist and [Indiscernible] the complexity has required but 14 Mark around patient care that was previously required where each person have their test but didn't have as much in her dependency as before and this drives change for positive better outcome. I wanted to mention what we are talking about today is super ultra topical. The state of union address mentioned a couple weeks ago, and also Friday there was another mentioned that the president has prioritized Bunnicula testing which often is what people mean by position medicine -- precision medicine and all this just happened. Cancer precision medicine is a big initiative and this is a big part of the initiative in the idea because cancer precision medicine and personalized medicine is where many of the advances have been very successful and this is a priority as stated by the government right now. Impact on Fridays summoner and announcement, there actually was a brain tumor patient invited to the White House for this announcement. It really is quite a topical thing right now in the news.

Something that we frequently get asked, is about the cost. It is good to know where is it within the grand scheme of patient treatment and care. Enlisted some rough ballpark type numbers to give you an order of magnitude that cost might be build or may be charged in order to perform a test and doing research on this I can say that these charges are someone in line with what we've we -- what we would pay in a laboratory setting. You can see that each any is the cheapest thing that would happen, FISH and genomic test require a lot of work and labor and those are up in the thousands. And I think we will talk about many different test today, but in similar ranges generally under anywhere from 5000 under anywhere from $5000 under anywhere from $5000-$1500. Whole genome something is around $10,000 for it to you -- for it to be useful. And I gave it a reference, and number I might run from 2000 and $4000 for head imaging of the brain it might be at the hiring and might even cost more with specialized techniques. Testing the you get usually is done once for a brain tumor patient and it is costly but actually in the relative picture of overall patient care and not that costly in particular that it won't happen overnight over like an MRI type of event and that is really important. People the patient's to get involved with the cost to pending on Monday -- where they are testing.
Tools, the first one will start with is the immune system chemistry which is biomarker markers inpatient samples. Chemistry is the first molecular test that was developed and really is generally in all pathology labs and it's available to all patients. Basically is working at one protein which is a product of maybe one gene and it is one test. It requires usually just one slide from a section of a patient sample. And it can be done on the smallest biopsies and it's very widely accessible and fast. -- It typically takes 1 to 2 days to performing get results back to the pathologist and Incorporated into the report which may take longer but as generally very rapid. Glial quest, is a chemical diagnosis and it has been changing over time and if in the most common adult brain tumor as many of you know it's resistant to chemo and radiation for the most part although you can have some responses and really the question is some patients live longer than others and respond better than others and with any of these type of test tried identify -- these type of test help identify those people. Chemistry used in diagnosis, looking at the protein expression which is a [ Indiscernible ] and there are a couple markers the one to talk about which are the most common and useful and those two are OLIG2 and GFAP . If you have a pathologist who is approaching a tumor they can run a Immunohistochemistry test. The OLIG2 is here in the Brown and it indicates that it is in the OLIG2 tumor. And GFAP does a similar type of thing.

Immunohistochemistry can also look at mutation so they may look at the GFAP -- IDH1 which is a common mutation in the subset of patients with glial, -- glioma -- glioma [ Indiscernible ] and the change in the DNA which leads to a change in the protein and the one that is most commonly used is an antibody IDH1 and this helps us to identify subsets of patients who have been astrocytoma that is not a glial out -- glioblastoma and there's a sample below that all the Brown are the nuclei or tumor cells that are staining strongly with the ID each one -- IDH1 . The normal neuron which was present within the biopsy material that was removed, and the normal neuron does not have the mutation. That indicates the stain is working well.

We have several of these another common one is IDH1 one. There is a number of other such as IDH1 to which can be used to evaluate tumors and mutation status within those tumors. These are things that if we think about, they are through their mutation are hoping to driver make the tumor growth so very important to evaluate those in patient samples. It can also help us with the determination of prognosis so this test them prognosis will talk about will tell you about an estimate of how fast the tumor might be growing or where in the spectrum of other patients might lie in as far as the aggressiveness. One that's very common is the MIB one or K1 67 that are growing within the tumor versus the blue circles are tumor cells that are not growing.
That calculating how many of these cells are growing within a tumor, sometimes this gives us a hopeful estimate as to how aggressive the tumor may be and again the IDH1 is very important as far as diagnosis and IDH1 is the presence of that mutation generally marks patients who have better prognosis and helps to distinguish those from patients who may have a slightly or less verbal prognosis. All can be done on one slide.

>> Often patients are considering clinical trials of experimental agents or novel therapies that are directed against some of these drug targets or drivers. EGFR Is one target and in a paper by mailing half, these two genes were felt to be interacting in a way that would help us diagnose or predict who might be a better responder versus or worse respond all and P 10 protein chemistry was one way of Immunohistochemistry would help identify patients. There is a lot of practice to doing this and many of these studies in research trials are being examined and currently we don't use this in clinical practices as much so I listed it as an example but right now it is still being evaluated, how this would help to indicate whether patients would respond or not and rainout it is a larger study -- and right now it is a larger study.

>> Trend 17 -- Immunohistochemistry has been done generally on single types of proteins or targets and there is some attempt to expand that to look at Multiplex four different types of expressions of proteins and RNA us that lead to proteins. This know is research and not clinical at this time. You may have seen places that offer access to such testing but for most academics, they are considered research testing not proven to be useful for clinical care. Expression profiling in the genome that list is something we use extensively to understand tumors and looking at the RNA by different genomic technologies but RNA is not clinical use frequently for GPM patients. These are some the names of companies that you might have seen offering such a test but again closely researchers consider these too early for implications of brain tumor patients and most hospitals don't run them although these types of tester medically available or clinically available.
Tools for personalized medicine, the next up will talk about the tool of cytogenetics with the changes in DNA. Generally a lot of the test are looking to matter the number of copies of the gene and is there again or loss with too many or too few for the cancer and does the gene appear intact are giving arrange for mixed up with a patient's DNA in the tumor or does the gene fused to another gene to make some type of protein that causes tumor to grow that number has been a normal cell. The best example with cytogenetics is [Indiscernible] and these are fairly rare tumors and occur in the brain with a striking pattern and with spaces around them shown down here and this type of histology is sometimes variable so looking at it through the microscope can be hard to diagnose if you might not be the future is needed. Number of years ago, it was noted that genetic events, rearranging -- rearrangement of genes with chromosome number one was reliably seen in at least 80% or maybe more of these patients leading to loss of chromosome number one and in chromosome patients. It's really important that [Indiscernible] is one of the tumors that have ID each one mutations as well and very quick Billy has an improved prognosis compared to others. They can respond to treatments quite well in many patients. It's important to identify it.

The genetics, we talked about the translocation that 19 Q is the most important but what I wanted to show in the research from there are many different associated genetics events that are known to drive progression to higher grade or less verbal prognosis and in the past we didn't have ways to pass all of these realistically for patients until we developed a molecular type testing that is able to do multiplexing or check multiple genes in advance at multiple times. There's data and information which one test might not be able to capture in the standard test that we have used for many years for diagnosis of burn -- brain tumor patients, is the FISH testing shown down here in example where basically each cell is looked at, the nucleus to see how many copies of the one [Indiscernible] regions there are and here is a nucleus that has green and red and two pairs normal and here you are missing the green signal and so that has been deleted. That it -- vessel has lost the signal and lost it -- that cell has lost the signal. This patient would be a co-deleted patient. Co-deletion is ruled out and helps the pathologist detect between hard cases versus Globe last.

Again these patients, it really does matter, glial -- glioblastoma is something that is quite different and in this case we have a patient that was diagnosed -- diagnosed in one center and by doing the FISH testing later, this make more sense because the patient did have a good long-term response to standard chemotherapy and radiation. And it would have been exceptional for a GPM to have where it was more understandable and expected. It really can help to change the diagnosis.
Astrocytoma and glioblastoma genetics, something like most of the common variance that has four or more different genetic events that need to be tested. The diagnostic tool that we use for that is implementation and GFR is a good one and in the past we tested using FISH to look for how many copies of the gene and EGF are when amplified, if hundreds or greater than 10 sure copies and about half the patients are present have this GBM and it is helpful in diagnosing and confirming. This is a picture of that so there is a picture we took samples from different regions of the brain and you can see each little brown dog is a copy of that e.g. F are and here is -- EGF are in here is a sample of the normal cell and next to it has too many copies of the gene in this diagnosis even on a single cell it goes for this region away from the tumor here.
Mr. powerful for identifying tumor cells but just one test and one gene. Can we use a different test to try and capture all those different genetics and molecular is at once? Likely we can so recently people have started using the ACG H with much more efficiency and brain tumors you think about different targets that we have for molecular events and Mrs. too many fish test if we want to know -- and this is too many FISH tests if we want to know. In check so the regions of the chromosome and DNA and how to do this, it is like a FISH test and similar to it that we take DNA from the patient sample and DNA from our reference and allow them to compete and instead of applying them to one less slide we apply them to a glass slide that has multiple pieces of DNA and the two normal DNA, they try to compete on the slide and the competition, whichever sticks most of the different regions of the chromosome that shows up as a red or green signal and this is a slide with the green and red them -- diagram. When together that make yellow and each dot is like having separate FISH test. This gives us a picture of a patient DNA and tumor genome. This is used to replace FISH and I'm showing examples from pediatric low growth -- low-grade which we started a lot at our institution. In many cases it's difficult to tell what the tumor is and in 2008 it was described of by a number of groups with a [Indiscernible] 1549 and that fusion event or molecular event produced what was a driver [Indiscernible] and diagnostic gene then for diagnosing astrocytoma. This is a clinical tested our institution and it looks at the whole genome and can find 42 other genes an aberration of that molecular events all in one patient tumor. Here in the red there are too many copies relative to the normal and each one is a fish test again and the green is too few copies. Like means it is the right number of copies and you can see the blip means there are too many copies. These tests are now able to be uniquely designed to the brain tumor specific and not offer get very widely at very many places. So I think this is something that is new and being ruled out in different hospitals. Whole genome, you can go back to the data without having to actually do another biopsy or without having to do any interaction with the patient, if there is a need or interest to go back to the data and look at other portions of the genome sides this and you can do it easily using analysis methods on the same data set. It's really very nice and takes about two weeks to do that type of test and another example, showing up pediatric unique event, one gain or application event is also something that can be detected and can replace the need for developing individual FISH test for each of the tumor types. The last thing we will talk about is DNA sequence and this is the newest type of tools that have been used and one thing that people might be familiar with, this looks a DNA sequence with methylation event of DNA in a specific sequence region and comparison of that it uses a technique which is methylation specific in order to determine what the methylation or tumor sample might be and one key element is that it is useful and used on all I grade and low-grade genome a. In comparison even though it can give you a little bit of information, it doesn't feel reliable or use information specifically for brain tumor patients at this point. Patients who have methylated GBM will survive and have better prognosis in response thing to treatment versus on methylated and is a cornerstone and analysis for patients right now.
A lot of the excitement is developing for position medicine and personalized medicine around multiplex sequencing. The more sequence you can generate, the more you can check multiple regions and gene targets to help patients and their diagnosis. Now there is many different types of drugs that are directed against particular point imitations and sequences and that's driving clinical trials and a lot of activity in this area. The idea is to generate as much information and many hospitals and companies have come up with sequencing panels or essays based on next General sequencing. Our test it is called hockey panel and its clinical research for clinical trials using this type of sick and thing in the idea is looking at 225 cancer-causing genes and it takes about four weeks and it is the same essentially the same test what foundation medicine rounds and other companies and it gives you lots of information about all of these genes and the holding if there's any mutation in those jeans, they usually able to be detected. Right now at our hospital, you can run many different test on many different patients and for instance 150 brain tumor patients were profiled in the first six months which is run here and really now thousands of profiles are generated in hospitals around the country and again these can be designed and often to cover many of the brain tumor patients specific and relevant targets. If you look you can have these types of events and reports generated which have a lot of data now in them and in fact this has created a need, that we need integrated reporting which is when you are generating multiple test like we talked about, we need to more integrate these types of reports and generate diagnostic target information in a holistic way as much is possible. This is something where pathologists are actively coming up with better and better ways to do this and fairly new.

One way the integration matters is interesting like to know the exact status of a pathway, if it's a tumor suppressor for [Indiscernible] that really is critical for the pathway and this should consider a trial of the drug, more seriously than another because their specific changes in the tumor an example here, where we took the result and looked at the patient, this patient had P10 loss through copy numbers and the other copy of P10 that was left behind which in activated that gene, this patient would have really quite a big problem in the P10, they don't have a functioning P10 anymore and in this case they would heavily consider for instance the trial of the Asian PK then -- PK and then they would be eligible for this trial where there might not be not any eligibility if they would know the status.
Now there is a big push in our center, in the community to come up with next generation clinical trials which use all this information integrated rule in order to try more rapidly find new and improved treatments for patients and how are we doing this? You have multiple arms of a single trial whereby a patient gets a genomic data for GBM and all of the genomic data helps decide which of the agency would pick from but get one treatment while on the trial and not just be shuffled off to find a trial on their own. This is what we are working hard towards right now so that patients have more options. And that research advances more quickly. And I think I will end on the slide, people want to know what testing should a tumor get and we can’t go through all 120 brain tumors because each one has a set of tests that if we take a couple examples such as a jewel -- adult GBM, trend 20 -- IDH1 is probably one of the most important testing in some type of essay whether its own multiplex a cappella for sequence or it can be focal events were you look at just by fish or sequencing for just one gene, either way they are important testing and pediatrics [ Indiscernible ] by some type of test and IDH and the broader testing for a cappella are for instance up purchase that we use at our hospital for every single patient should there be a enough tissue and my last went, there is a lot more need for patients and clinicians to be understanding tissue paneling is for consideration and all of these require a certain amount of tissue. Molecular diagnosis is 10 to 20 slides, and clinical trials require tissue for their analyses and for patients to go on trial. Right now we have some patience and some situations where we have to be working together as a team with the patient and the treatment physician to decide what are the most highest priorities and how do we want patient tissue used. That is something that a patient should be aware of going forward and they are part of that conversation. I want to acknowledge ABTA for this wonderful format and there webinars and seminars. And their scientists across the country who have done great jobs.

Thank you. That was very informative. We received a number of great questions and so without further ado, we will ask the first one. Can every doctor administer position medicine?

-- Precision medicine?

Is a term that encompasses a law spectrum that we just talked about. Every doctor is able to do pushes in medicine that -- precision medicine. Having pathologists use and generate data on that, and Incorporated and talk about it with oncologists and patients, it something that can be done everywhere. The spectrum of testing we just described is particular the multiplex test and they are fairly new and they have not quite entered into every single hospital regiment of how they approach patient -- patient care. Certainly it does depend and it’s a good question, it depends on where you are being seen for in tumor patients to be given their particular needs and we do encourage trying to go to centers that would have availability of these types of training from the beginning. The amount of tissue and things available, the knowledge needed to make these test happened is coordinated and it’s important to get to the right hospital at the right time in your care so you have options for these sets of things.
Thank you.

The next question is, is molecular testing part of the standard discussion between doctors and patients and what can patients do if a doctor does not bring up molecular testing?

They should bring up molecular testing and don't be shy about it. It is important to have the patient's role in the physicians may or may not -- it is important to ask the patient several that may or may not [Indiscernible]. There may be a wide variation from center to center and I think it is important to bring it up or Mac mini physicians and --.

Many physicians and patients will send information to another site and with hours and any other cancer centers, if and their material for analysis and maniacal are precision analysis so that their physician can have access to it if they don't have it in their local group. It is something that patients should ask about and for instance, the test for IDH is very simple test and it's very important test for each patient for instance where they [Indiscernible] in really it is not something out of the reach of most you -- centers to perform.

Would this be blood or tissue that is used?

Almost all the tests only require tissue or tumor tissue for analysis. Some of the sequencing and multiplex tests are sometimes run clinically with patient normal blood or tissue for a comparison but for the most part everything is able to be run on paraffin tissue which is very important. If you have a tumor surgery where they were not able to do frozen which is the most popular, tissue is where we have been able to develop [Indiscernible] so they can be applied to routine tissue but it does require a certain amount of tumor to do that. Usually some of the molecular test can be run just not all of them.

Is there something a patient Hindu if there's not enough tissue for -- is there something a patient can do if there is not enough tissue -- tissue to be tested?

Yes discuss with your physician and have a conversation about what else can be done to generate more information or data. The usual answer to that is that yes there usually is something more that can be done and it often my require submitting more coordinating submission of your sample to another hospital or cancer center that has those tools available and again that standard practice, every single cancer center does except consultation. And they can work to generate more medically data that was more than initially done. It is able to be done at other sites if the patient or clinician ask for it.

What is the difference between molecular testing and genomic testing?
They are one in the same. The number of terms that you will hear out there, they are genomics, genomic testing, molecular medicine, molecular test, molecular pathology, pressures and medicine -- pieces in medicine and all of these things are -- precision medicine and all of these things are copy number analysis or and everything we talked about was under that or Mac --. Because often people are talking about sequence thing or copy number or more multiplex a race which is looking at multiple genes and proteins instead of just one at a time. Often that is what people are talking about all terms are used when and meaning the same thing.

The final question, is it possible for a lower grade tumor to suddenly turn into a GBM and does it require additional testing once it has become more advanced?

Yes, for low-grade tumors, it really depends on the exact diagnosis and class. There are a number of low-grade tumors that have a certain rate of transfer nation into tumors. Lower grade genome is can be calm more aggressive -- can become more aggressive. It's definitely a pattern that can happen. One of the things that happens, when different pathologists and genetic molecular testing data is applied to a tumor, sometimes tumors that were originally called low-grade, with more tests we may be able to determine even though we had hoped it was originally low-grade, sometimes genetics change the diagnosis or great into a higher grade tumor. Sometimes they change a higher grade into a lower grade. Sometimes it doesn't happen super frequently that you change diagnosis but it does happen enough that it is worth having second opinions and consultations, given the patient doesn't have to travel only there tumor tissue sample and travel, it's important to do to get second opinions from places that do run those type of test.

That is all we have time for today. Thank you all for joining and thank you again to Keith Ligon. For more information, our licensed healthcare professionals can provide you with support and help you navigate information available on our website. Please fill free to call the ABTA Caroline. -- Care line.

Let's pause for a moment to conclude our wedding -- webinar.

The next webinar is the second part of the two-part series on molecular -- molecular testing. This is scheduled for Wednesday, February 18, 2015 at 11 AM and 12 PM central time. The topic molecular testing will be facilitated by Dr. Patrick when. They will provide information on the roles of molecular testing and diagnosis of an tumors and with the focus on glioma.
>> This concludes the webinar. Thank you for joining. Please fill out the survey you will receive tomorrow.

>> This concludes our webinar.

>> Thank you.

>> [ Event concluded ]

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